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Cannula Tracheostomy and Physiotherapy

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CANNULA TRACHEOSTOMY AND PHYSIOTHERAPY - MOODLE ONLINE COURSE

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Patients being discharged to non-specialised areas in managing tracheostomised patients due to the increase in tracheostomy performance has led to infrequent recovery treatment. Studies show that lack of skills healthcare professionals has raised the needs and concerns for proper guidelines in managing the patients. Even though there are several guidelines for the treatment for tracheostomised patients, the lack of guidelines for physiotherapist team in ICU has been proven to affect the recovery phase of the patients. Lack of guidelines in multidisciplinary team management and lack of information in importance of the physiotherapist's involvement in the care team is evident.

The increasing studies that are being performed the efficacy of physiotherapy interventions have created a strong awareness among the healthcare professionals. The treatments that are administered by physiotherapists vary between countries but the main goal of improving the quality of life of the patients is the focus among the physiotherapists everywhere. The main interventions that the physiotherapists focus on are improvement of respiratory care, mobilisation and strengthening, and functional ability to prevent further complications and to improve the quality of life. The efficacy and consistency of the interventions that are provided for the tracheostomised patients shows the need that it should be studied further. The lack of evidence of interventions that are tailored mainly towards the tracheostomised patients leads to generalised physiotherapy interventions rather than individualised interventions. Thereby, further development is needed to identify the best methods that are suitable for tracheostomised patients as well as improvement in staff education who are treating tracheostomised patients is needed.

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1 INTRODUCTION

There is an increase in the numbers of patients who are tracheostomised being discharged to areas that are not specialised in tracheostomy care. The involvement of a physiotherapist in the multidisciplinary management team lacks, which affects the recovery of the patients. Therefore, this thesis provides the knowledge on physiotherapy approach on managing patients with tracheostomy.

The process of getting and having cannula tracheostomy can be scary for a patient, but it is necessary for a patient who has trouble breathing, swallowing and are at risk of aspiration. Aspiration is the act of breathing with saliva, liquids, or food. Therefore, tracheostomy is performed to provide an airway. Tracheostomy is also done when a patient faces problems with coughing up mucus and provides an easy way to suction the mucus out. (Craig Hospital, 2017).

Physiotherapists working in conjunction with the multidisciplinary team is pivotal for the patient's well-being. Preventing the long-term complication which leads to decreased quality of life and increased healthcare utilisation of tracheostomised ICU patients require the physiotherapist's involvement. The growing awareness of benefits of early physiotherapy interventions within the healthcare team allows the patients to achieve their overall goals of decreased prolonged stay in the hospital, ventilator- free days, improved respiratory function which leads to fast weaning off process, and improved functional abilities physiotherapist (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398).

2 AIM AND OBJECTIVE OF THE THESIS

The aim of the thesis is to provide the student with the information about why tracheostomy is performed, benefits, risks, and the role of physiotherapy on treating cannula tracheostomy. The objective is to provide the information through the moodle online

course. The course consists of study materials which include quizzes and small tests for the students to partake.

3 CANNULA TRACHEOSTOMY

Tracheostomy is the stoma (the hole made in the neck and trachea), in the trachea (windpipe) made by the surgeon between the clavicles to replace a person's nose and mouth as a pathway for breathing. To keep the hole open and to deliver an entryway into the lungs, the tracheostomy tube (trachea) is inserted into the stoma. Tracheostomy is done when a person is in the intensive care unit (ICU) or when a person has troubles with breathing due to traumatic brain injuries as well as spinal cord injuries which requires for the management of chest and lungs in order to increase the success of recovery with the rehabilitation process (Craig Hospital, 2017).

3.1 Need for the tracheostomy surgery

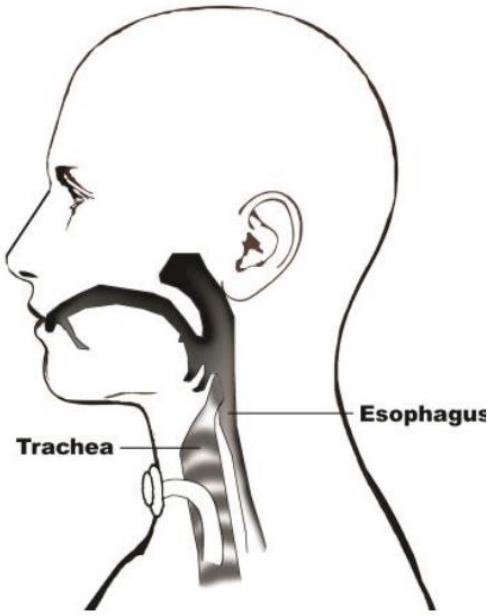
A physiotherapist will come across a patient who has tracheostomy done whether in the ICU or in cardio wards. Physiotherapists' task is to guide the patient towards recovery and their goals in order to get back to their functional level to be able to participate in the activities of daily living which includes bathing, dressing, eating, grooming, work, cleaning, and chores (ADL) and instrumental activities of daily living (IADL) which includes activities such as manging money, moving within the community, transportation, and taking medications. To plan the rehabilitation process, the physiotherapist must know how to train a patient with tracheostomy. Tracheostomy has many different levels of trachea which determines the severity of the condition. Therefore, having the knowledge on how to train a patient with a tracheostomy is necessary as a physiotherapist (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398).

The tracheostomy is performed on a patient due to the conditions that are obstructing the flow of the air into the lungs, primarily to deliver oxygen into the lungs easily and

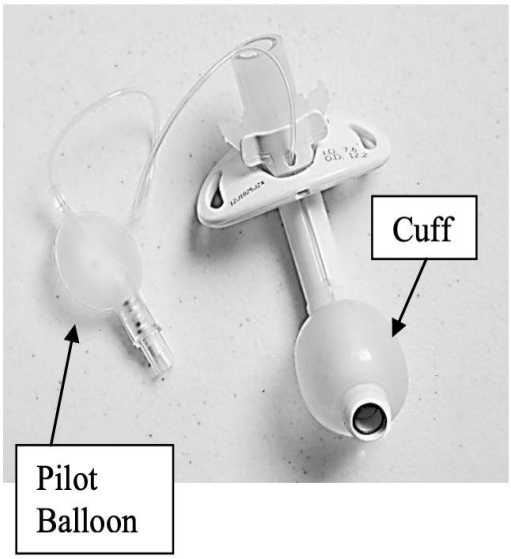
safely and to remove the secretion (e.g. mucus) that is causing difficulty in breathing and aspiration. The problems which lead to the surgery can be categorised into three categories as airway problems, lungs problems, and other problems. Airway problems that may contribute to the obstruction are, for example, severe burns from fire accidents or swallowing corrosive substances or infections, such as epiglottitis. Chest injuries, diaphragm dysfunctions, or the need for prolonged respiratory support are considered as lung problems which may lead to the tracheostomy surgery. Prolonged unconsciousness or coma, neuromuscular injuries, or spinal cord injuries which lead to fracture of vertebrae are categorised into other problems that contribute as the reasons for the surgery (Molanr, 2019).

3.2 Types of tracheostomy tubes and their roles

The different types of cannula tubes that are utilised can be confusing, but it is easier to learn the differences by their appearance. Picture 1 (Craig Hospital, 2017) shows the anatomical position of where the tracheostomy is performed. Tubes can be identified by the presence or the absence of a cuff, of an inner cannula, or of a fenestration. The tubes are made from several different materials and into different diameters and lengths for an accurate fit for a patient. The tubes are often made from medical grade polyvinyl chloride, silicone, polyurethane, or combination of these materials (National tracheostomy safety project, 2013).



Picture 1: anatomy of tracheostomy



Picture 2: cuffed tube

The outer cannula is the main body of the tube. The trach tube in Picture 2 (Craig Hospital, 2017) has a cuff which helps the patient is on the mechanical ventilator. The cuff represents the balloon attached to the tube. The cuff makes sure that the air is entering the lungs instead of escaping through the nose and mouth as well as in the prevention of the aspiration of the saliva in patients who have trouble breathing (Craig Hospital,2017).

The cuffless tracheostomy tube in Picture 3 (Craig Hospital, 2017). are used in patients who has the ability to swallow, can breathe on their own and is used for the patients who are not assisted by the ventilator. The tube can assist in cleaning out the lungs by acting as a port for suctioning (Craig Hospital, 2017).

Picture 3: cuffless tube

Picture 4: inner cannula tube

The tube that shown in Picture 4 (Craig Hospital, 2017) is utilised in patients who have trouble breathing the saliva is identified as an inner cannula and it acts as a liner that fits inside the trach. The inner cannula can be removed and cleaned as needed since it helps prevent the build-up of mucus inside the trach tube (Craig Hospital, 2017).

The metal tracheostomy tubes shown in picture 5 (Craig Hospital, 2017) do not have cuffs but are used for their low infection rate. Metal tracheostomy tubes can be sterilised and reused, which reduces the cost of treatment. Another great reason the metal trach tubes are used because they have thin walls which allow greater airflow compared to the plastic trach tubes (Craig Hospital, 2017).

Picture 5: metal tubes

There are several other special tracheostomy tubes that are used to assist the condition of the patients better. For example, there are fenestrated tubes, single and double cannula tubes, tubes with subglottic suction, and adjustable flange tubes. The choice of the tracheostomy tube is decided by the physician based on the patients' needs, but these special tubes have their disadvantages as well, such as tube obstruction and constant removal of the tube due to the construction which puts the patients at risk since the tube should not be removed or changed for 7-10 days after the percutaneous stage. Clinical environment affects the choice of the trach tubes as well since an obstructed is a high risk. Simpler tubes with clear and easy instruction will reduce the confusion. Therefore, careful assessment is done before the tracheotomy (National tracheostomy safety project, 2013).

There are several other factors that should be considered when managing a tracheostomised patient. Humidification is such a factor. When breathing through a foreign object, the air is not filtered, warmed, and humidified compared to breathing through the mouth or the nose. Therefore, most patients that tracheostomised will require a humidifier which will warm and humidify the air (Craig Hospital, 2017).

3.3 Benefits of tracheostomy

Tracheostomy is performed with the evaluation of the condition of the patient, and the benefits tracheostomy provides to assist the patient to the path of a healthy recovery (Keynes, 2011; Doyle & McCutcheon, 2012, 10). Patient groups that benefit from the tracheostomy are the patients with trauma, neurological damage from a stroke, spinal cord injury (SCI), and head injury (Cheung & Napolitano, 2014, 895-915).

Tracheostomy is comfortable compared to the mouthpiece that can be used for breathing assistance. Keeping the mouth and the assistive devices clean are crucial for the prevention of complications as such infection that will complicate the recovery of the patient (John Hopkins Medicine, 2019). Tracheostomy has been proven to be more comfortable for the multidisciplinary team to clean the mouth and the tubes. The patients benefit from the factor which is being able to move the mouth which in turn benefits the factors such as help the patient with communication since it is attached below the voice box, as well as eating. Tracheostomy is easier to wean off the breathing support and easier to come off the sedation which assist the patient to comprehend the where and what better compared to other procedure such as mouthpiece breathing support option (Keynes, 2011).

3.4 Communication

Tracheostomy affects the patient's ability to communicate with others to express their needs. The reason for getting tracheostomy done and other factors such as the condition of the vocal cords determines whether the patient is able to communicate. Difficulties with the aspect of communication can be expected between 16% and 24% in the patients. Assessment, diagnosis, and prognosis of communication and swallowing difficulties are a vital task for the respiratory and speech and language therapist along with other healthcare professionals who are in the multidisciplinary team. (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398).

Communication with the tracheostomy is difficult but a necessary aspect for the recovery of the patient. Several criteria should be met before moving to the communication phase. The criteria include, chest X-ray will be taken to determine if the patient is clear of pneumonia due to aspiration. The respiratory therapist and the physiotherapist will assess the patient's ability to cough and clear out the mucus (Craig Hospital, 2017). The respiratory therapist will evaluate the patient is readiness to start using the speaking valve based on the evaluation such as the swallowing safety results (Craig Hospital, 2017; Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398). The respiratory therapist will inform the multidisciplinary team regarding the protocols such as the duration where the stoma can be closed to allow the patient to speak. If the patient had the tube with the cuff, it should be deflated before closing the stoma to allow the patient to speak. As the patient's breathing pattern improves, the stoma will be deflated for a short amount of time, then the duration will be gradually increased (Keynes, 2011). The nursing staff, physiotherapists, speech and language therapists, and other health care professionals use the protocols provided by the respiratory therapists in their therapy implementation (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398).

3.5 Weaning off process

Decannulation process begins when the patient is recovering steadily without any complications. The tracheostomy tube can be removed when the patient has no difficulty with breathing and the steady healing of the airway to the point where the tube is no longer required (Craig Hospital, 2017). The decannulation process is done depending on the type of the tracheostomy tube as well, which affects the timeline of the weaning off process. Depending on the type of tube of the patient, the process may involve reducing the size of the tracheostomy tube. When the patient is ready, the tracheostomy tube will be replaced with a mini-trache which a lot smaller than the standard tracheostomy tubes. The tracheostomy will be fully removed when the patient is strong enough to clear out the mucus by coughing themselves, the lungs are functioning correctly, the breathing pattern is controlled, safe from swallowing their saliva into the lungs, able to tolerate the deflation for twenty-four hours, has controlled airflow

through the mouth and nose, and the chest is clear off phlegm and no presence of concern regarding the breathing (John Hopkins Medicine, 2019; Keynes, 2011, 1-10; Doyle & McCutcheon, 2012, chapter 10).

The tracheostomy will be removed by the bedside since it is an easy process. The opening will close in about five days. Sometimes the healing will take longer than predicted, but the nursing team will keep an eye in the dressing of the wound to prevent complications such as infection. After the decannulation, the patient will be monitored carefully, and if any complications arise, such as the patient is not able to breathe properly, tracheostomy will be done with the mini-trache. It will progress from there again (Keynes, 2011).

3.6 Potential complications

Complications may arise in tracheostomised patients due to the prolonged stay and while invasive therapies are performed, such as suctioning. Potential complications are categorised into early complications and delayed complications. The early complications that arise in tracheostomised patients include infection, bleeding, injury and damage to the nerve that activates the vocal cords, trapped air around the lungs, around the deep layers of the chest, and underneath the skin around the tracheostomy, and damage to the swallowing oesophagus, (John Hopkins Medicine, 2019; Keynes, 2011, 1-10; Doyle & McCutcheon, 2012, chapter 10).

The complications that arise later would be accidental removal of the tubes, and damage to the windpipe due to the scar tissue, bacteria, and due to the pressure of the tube itself. There are several other complications that arise from the long-term presence of tracheostomy may include collapsing or narrowing of the airway tract, which requires additional surgery to repair it. Additional surgery may be needed when the stoma does not close on its own after the removal of the tubes. Patients should be evaluated beforehand in order to prevent complications. If the patient is a new-born or an infant, smoker, diabetic, alcoholic, taking steroids or cortisone, with the compromised immune system, and has chronic respiratory infections or has chronic diseases, they have a higher risk in acquiring complication early or later (John Hopkins Medicine, 2019).

These complications delay the recovery period of the patients considerably. When more surgeries are required the increase in prolonged bed rest increases leading to muscle atrophy. Prolonged bed rest has been proven to lead to substantial changes in the body (Marlou L. Dirks et al. 2016, 2862-2875). Deconditioning in tracheostomised patients have been proven to contribute to patient's morbidity and mortality rate as well (Lee et al, 2016, 32).

4 INVOLVEMENT OF THE MULTIDISCIPLINARY TEAM IN TRACHEOSTOMY TREATMENT

According to the studies that have been done regarding the importance of the role of the multidisciplinary team in the hospital environment including the recovery of a patient (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398), the role of the multidisciplinary team plays a vital role in the treatment of the tracheostomised patient as well. Skilled and knowledgeable healthcare professionals in the multidisciplinary team are important in preventing complications as well as speeding the recovery of the patients (Yu, 2010, 109).

The increase in evidence and studies shows that a well-coordinated team can influence the quality of care, which affects the recovery of the patient as well as their family. The team mostly consists of doctors, nurses, speech therapists, respiratory therapists, physiotherapists, dieticians, psychologists, and other knowledgeable members based on the care the patient needs to recover without complications (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398). The involvement of the multidisciplinary team is necessary and vital for a recovering patient. The teamwork within the multidisciplinary team provides knowledge that is necessary for the care. In a recent study, a question was raised whether the background of the physician important or the multidisciplinary team and the importance of a physician's knowledge was discarded compared to the multidisciplinary team because it was concluded that the healthcare professionals that make up the multidisciplinary team have close contact with the patients

compared to the physician. Therefore, a knowledgeable team of healthcare professionals are necessary for a recovering patient (Yu, 2010, 109).

5 ROLE OF THE PHYSIOTHERAPIST IN MANAGING CANNULA TRACHEOSTOMY

Physiotherapist, who are skilled in the multisystem assessment of the intubated and mechanically ventilated patient in the multidisciplinary team is vital for the patient to recover (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). The physiotherapist will assist with several aspects of the treatment while the patient is in the ICU for the tracheostomy treatment, and will continue to work with the patient when transferred to the general ward until the patient leave from the hospital (Keynes, 2011, 1-10; Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398). Along with the primary respiratory care, other key roles involve the management of musculoskeletal and neurological complication that arise during critical care. Traditionally, the primary focus of the tracheostomy was the management of respiratory functions. However, the increase in evidence that patients in critical care, such as tracheostomised patients, have long-term limitations of functional skills which leads to weakness has guided the physiotherapist to incorporate exercise rehabilitation into the therapy plan (Pathmanathan, Beaumont & Gratrix, 2015, 20-25)

The role of the physiotherapist in the management of tracheostomised patients varies, but there is the treatment plan that is utilised worldwide are similar and focuses on the primary aspect which is the smooth recovery of the patient. There is a lack of randomised controlled trials in the role of the physiotherapist on the management of the tracheostomised patients, but the long history provides the evidence of physiotherapist playing a pivotal part in the management of critical care (Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

5.1 Respiratory care

Chest clearance has been the focus in physiotherapy treatment for the tracheostomised patients (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398). As early as 1915, chest clearance has appeared as management and remains as a key role in managing the tracheostomised patients whose are unable to cough, swallow and humidify chest secretions which indicate the severity of the impairment (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398; Pathmanathan, Beaumont & Gratrix, 2015, 20-25). When the ability cough is impaired or inhibited, and due to the fact of the diminished function of the mucociliary escalator by the intubation, there is a higher chance that it will lead to pneumonia due to the sequestration of secretion which acts as a medium for the bacteria growth (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). Patients who are on the mechanical ventilators such as tracheostomy are given drugs such as opioids with antitussive effects and neuromuscular blockers that block-out the cough reflex (Lyons P. G. et al. 2017, 428-434; Pathmanathan, Beaumont & Gratrix, 2015, 20-25). Furthermore, the tracheal tube in the trachea prevents the cough reflex as well, and it can translocate the bacteria from the oropharynx. These factors lead to the impairment of the cough induced clearing mechanism that can lead to the functional deterioration of the lungs, ventilator-associated pneumonia (VAP), prolong the weaning off process, and may increase mortality (Pathmanathan, Beaumont & Gratrix, 2015, 20-25; Spapen, Regt & Honoré, 2017, E44-E49).

5.2 Positioning

Positioning is another pivotal mechanism that physiotherapists manage in the respiratory care of tracheostomised patients. Providing patients with stability and comfort, which leads to a calm and relaxed setting through positioning will leave a positive effect on the recovery of the patient. Positioning allows other healthcare professionals to do their care, such as dressing and hygiene procedures, ergonomically without hurting themselves and the patients. Unfortunately, many healthcare professionals are uncertain with the positioning; therefore, the physiotherapist often gives guidelines on positioning to other healthcare professionals in the team (Maindal, 2020).

Furthermore, tracheostomised patients mostly lay in the supine position, which leads to airway closure in dependent lung regions. Chest and abdominal wall compression lead to increase in airway resistance and in addition, there will be an increase in the work of breathing, decrease in lung compliance, and ventilation mismatch. Proper positioning leads to increased volume to the lungs which enhances secretion clearance and breathing sound. Regular turning from side to side may reduce or prevent patient acquiring VAP so long as a $>40^{o}$ lateral turn is achieved and is supported by some evidence. Lateral rotation therapy requires specialised beds that is programmed to rotate along the longitudinal axis including pre-set speed and degree of rotation. It has been found that altering patient's positions alters ventilation profusion mismatch (V/Q). When the patient is positioned from supine to standing, there is an increase in displacement of rib cage by 63.8%. Furthermore, the prone positioning the patients are not discussed much due to the need for extra attention and care. There is an increase in positioning the patients in prone position to the patients with respiratory complications. The recent pandemic COVID-19 affects the respiratory system severely and this has led to the inclusion of prone positioning as a treatment. Prone positioning is important as well in mechanically ventilated patients to increase the oxygenation. The mechanics and physiology of gas exchange is altered by prone position which leads to optimised oxygenation. Prone position improves gas exchange by reducing dorsal lung compression and improving lung profusion (Malhotra & Kacmarek, 2020).

It is best for the therapists to be selective with positioning based on individual need to avoid position dependency and the therapist (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). Indications and contraindication of each treatment approach should be assessed properly to avoid complications. Therefore, incorporating positioning techniques in, such as chest management to clear the phlegm and to prevent the complications tracheostomised patients meet leaves a positive impact on the recovery phase (Maindal, 2020).

5.3 Mobilisation

Prolonged immobilisation has been a proven to be harmful to the patient rapid increase in muscle atrophy, reduction in bone mineral density, and impairment in other body

systems which is evident within the first week of bed rest and exacerbated further due to the delay in the weaning off process. To minimise the metabolic demand on the body to promote recovery and to enable the body to focus on the healing, the bed rest mechanism was first introduced in the 19th century. However, increase in the new studies have shown that the prolonged inactivity has significant consequences on the musculoskeletal, cardiovascular, respiratory, cognitive and integumentary system which leads to further complications (Parry & Puthucheary, 2015, 4).

Bed rest has molecular and systemic effects which ultimately affects the functional outcomes of the patients after the removal of the tracheostomy tubes (Winkelman, 2009, 254-66). Tracheostomised patient's workload increases, leading to a decrease in the function of the respiratory pump. Drugs such as neuromuscular blocker and steroids contribute to the exacerbation of the problem and malnutrition further contribute to the problem as well (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). Prolonged inactivity and immobilisation lead to prolonged ventilation and delays the weaning off process. Therefore, to prevent the complications that arise from the immobilisation of muscles, joints, and inactivity that contributes to cognitive problems and malnutrition, physiotherapists put a primary focus on mobilising the patient while the patients are in bed rest. This approach prevents from patients having severe and significant neuromuscular complications that impair their physical function that affects their quality of life after the hospital discharge which prevents the patients from returning to the hospital (Needham, 2008, 300).

The national institute for health and clinical excellence (NICE), European society of intensive care medicine and the European respiratory society recommend that the physiotherapists and other healthcare professionals should provide the early assessment and management of the physical condition that includes mobilisation and muscle training (Charted society of physiotherapy, 2011). They recommend that the physiotherapist should be responsible for planning and implementing mobilisation prescriptions in co-occurrence with the multidisciplinary team (Pathmanathan, Beaumont & Gratrix, 2015, 20-25; Charted society of physiotherapy, 2011).

Therefore, a physiotherapist's role in the management of the tracheostomised patient is a potent factor. The physiotherapist works with the multidisciplinary team and the

patient to prevent the adverse effect of the conditions which are the physical inactivity leading to muscular atrophy and general weakness, joint pain due to prolonged bed stay, diaphragmatic weakness due to the prolonged assistance of the tracheostomy, compromised cardiac and respiratory functions, and pressure ulcers (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398; Pathmanathan, Beaumont & Gratrix, 2015, 20-25; Charted society of physiotherapy, 2011). Rehabilitation process that is implemented early provides improved respiratory and limb muscle strength which leads to better functional independence in ADL (Charted society of physiotherapy, 2011).

6 PHYSIOTHERAPY TREATMENT APPROACH

Physiotherapy interventions begin immediately as the patient is admitted to the ICU ward. The physiotherapist in the multidisciplinary team will assess the condition of the patient before planning the therapy implementation (Wong, 2000, 662-670). Identifying the short- and long-term goals for the therapy is crucial before implementing the plan. The goals are oriented around the patient in order to minimise the adverse effect that the intubation inflicts (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). The elements that affect the rehabilitation process are the conscious state, psychological status, and physical strength of the patient. Rehabilitation goals are tailored toward the patient that incorporates the elements that affects the rehabilitation process. (Charted society of physiotherapy, 2011). Goal-oriented progressive physiotherapy that incorporates mobility such as walking while ventilated is necessary and essential in preventing the functional decline of the patient.

Furthermore, goal-oriented rehabilitation that commences early prevents the increase in the cost of service provision to the health system by shortening the stay in the hospital and the rehabilitation period, and preventing the long-term follow-up rehabilitation that may happen due to the prolonged inactivity (Charted society of physiotherapy, 2011). Therefore, the goals are crucial in planning the rehabilitation that is tailored towards the patient's condition (Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

General goals of physiotherapy would be improving respiratory, peripheral, and limb muscles strength, decreasing the dependency on the ventilator and improving residual function, preventing post-operative complications, preventing the possibility of increased stay in the ICU and the hospital to reduce patient morbidity and mortality, improving secretion clearance, and maintaining lung volume (Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

Assessment of the patient condition is a crucial step for setting the short-, medium-, or long-term goals. According to the NICE guideline, it is recommended that the assessment of the patient should include both physical and non-physical categories. The physical category covers the aspects of strength, range of motion (ROM), and functional ability, whereas the non-physical category covers the aspects of cognitive and psychological ability (NICE, 2009, 1-92). NICE clinical guidelines have recommended an assessment plan that can be used by the physiotherapist. Table 1 (NICE,2009, 1-92) shows the examples of short clinical assessment that assist the physiotherapist to identify if the patient is at risk of developing physical or non-physical morbidity.

Table 1: morbidity risk assessment

Physical	Unable to get out of bed independently. Anticipated long duration of critical care stay. Obvious significant physical or neurological injury. Lack of cognitive functioning to continue exercise independently. Unable to self ventilate on 35% of oxygen or less. Presence of premorbid respiratory or mobility problems. Unable to mobilise independently over short distances.
Non-physical	Recurrent nightmares, particularly where patients report trying to stay awake to avoid nightmares. Intrusive memories of traumatic events which have occurred prior to admission (for example, road traffic accidents) or during their critical care stay (for example, delusion experiences or flashbacks). New and recurrent anxiety or panic attacks. Expressing the wish not to talk about their illness or changing the subject quickly off the topic.

Note: this list is not exhaustive and healthcare professionals should use their clinical judgement.

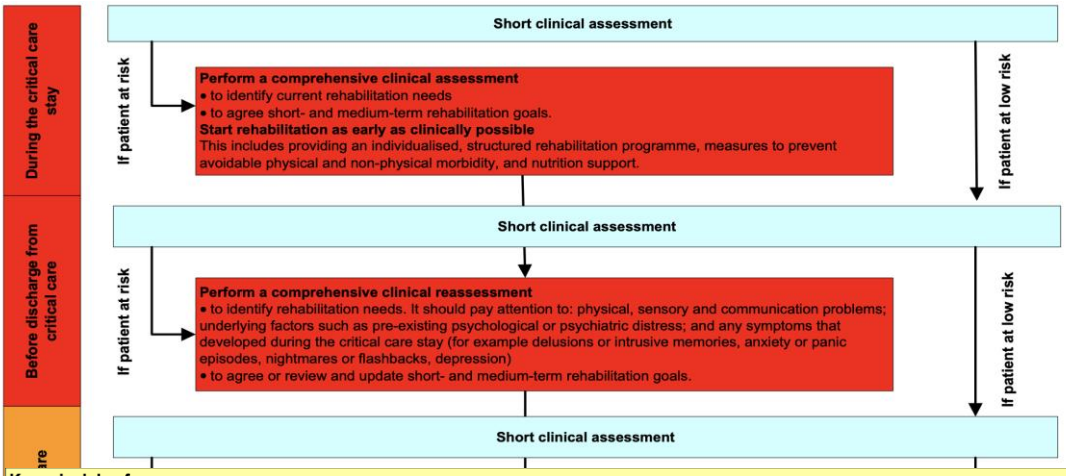
Whereas, table 2 shows the possible symptoms that can be identified through the functional assessment that may contribute to the patient's morbidity rate that can affect the recovery time period (NICE,2009, 1-92).

Table 2: functional assessment of symptoms

Physical dimensions	
Physical problems	Weakness, inability/partial ability to sit, rise to standing, or to walk, fatigue, pain, breathlessness, swallowing difficulties, incontinence, inability/partial ability to self-care.
Sensory problems	Changes in vision or hearing, pain, altered sensation.
Communication problems	Difficulties in speaking or using language to communicate, difficulties in writing.
Social care or equipment needs	Mobility aids, transport, housing, benefits, employment and leisure needs.
Non-physical dimensions	
Anxiety, depression and PTS-related symptoms	New or recurrent somatic symptoms including palpitations, irritability and sweating; symptoms of derealisation and depersonalisation; avoidance behaviour; depressive symptoms including tearfulness and withdrawal; nightmares, delusions, hallucinations and flashbacks.
Behavioural and cognitive problems	Loss of memory, attention deficits, sequencing problems, deficits in organisational skills, confusion, apathy, disinhibition, compromised insight.
Other psychological or psychosocial problems	Low-self-esteem, poor or low self-image and/or body image issues, relationship difficulties, including those with the family and/or carer.

Table 3 shows the care pathway guide created by NICE. These guidelines provide necessary information that should be taken into to consideration by the physiotherapist to give the optimal care for the patient who is in the ICU for tracheostomy for other problems (NICE,2009, 1-92).

Table 3 process of clinical assessment



Key principle of care

To ensure continuity of care, healthcare professional(s) with the appropriate competencies should coordinate the patient's rehabilitation care pathway. Key elements of the coordination are as follows.

- Ensure the short- and medium-term rehabilitation goals are reviewed, agreed and updated throughout the patient's rehabilitation care pathway.
- Ensure the delivery of the structured and supported self-directed rehabilitation manual, when applicable.
- Liaise with primary/community care for the functional reassessment at 2-3 months after critical care discharge.
- Ensure information, including documentation, is communicated as appropriate to any other healthcare settings.
- Give patients the contact details of the healthcare professional(s) on discharge from critical care, and again on discharge from hospital.

Information and support

During the critical care stay, give information about:

- the patient's illness, interventions and treatments, equipment used, any short- and/or long-term physical and non-physical problems if applicable. This should be delivered more than once.

Before discharge from critical care or as soon as possible after being discharged from critical care, give information about:

- the rehabilitation care pathway and, if applicable, emphasise the information about possible physical and non-physical problems
- the differences between critical care and ward-based care and the transfer of clinical responsibility to a different medical team
- sleeping problems, nightmares and hallucinations and the readjustment to ward-based care, if applicable.

Before discharge to home or community, give information about:

- the patient's physical recovery (based on the goals set if applicable) and how to manage activities of daily living
- diet and any other continuing treatments
- driving, returning to work, housing and benefits (if applicable); also local support services
- general guidance for the family/carer on what to expect and how to support the patient at home.

Give the patient their own copy of the critical care discharge summary.

Short-term goals are focused around the pivotal aspects such as early activity which focuses around both active and passive activity to prevent the muscle atrophy, positioning which encourages the sputum clearance from the lungs that utilise gravity's assistance, manual techniques such as vibrations and shaking to clear the sputum, and suctioning. These short-term goals are vital in the weaning off process (NICE, 2009, 1-92; Pathmanathan, Beaumont & Gratrix, 2015, 20-25; Charted society of physiotherapy, 2011). Long-term goals focus on the aspects of planning and the implementation of a rehabilitation programme to allow the patient into the society without any major problems that may inhibit the functional ability (NICE, 2009, 1-92; Pathmanathan, Beaumont & Gratrix, 2015, 20-25). Furthermore, rehabilitation goals are set with communication and conjunction with the patient, family, and other healthcare professionals. Goals can be divided into short-, medium-, or long-term in accordance with the patient's condition throughout the rehabilitation process since the condition can fluctuate. Contributors for the fluctuation in the condition can be both physical and psychological. Therefore, the goals should be set according to the regular assessment of the patient's both physical and psychological condition and should be changed, if necessary, according to the progression of the recovery phase (Rahimi et al. 2013, 248-255).

6.1 Chest physiotherapy and respiratory management techniques

Chest physiotherapy is recognised as an important initial treatment in tracheostomised patients. Tracheal intubation has a serious effect on the patient's recovery. For the purpose of accelerating the recovery phase and preventing further complications, the physiotherapist disposes of effective diverse rehabilitation in breathing methods, manual techniques, and mechanical devices or combination of both (Spapen, Regt & Honoré, 2017, E44-E49). A randomised controlled trial study has concluded that the elements of chest physiotherapy that were done twice a day for five days improved weaning off phase, as well reduced the duration ICU stay, and prevented lung injury that is caused by the ICU period (Berti et al. 2012).

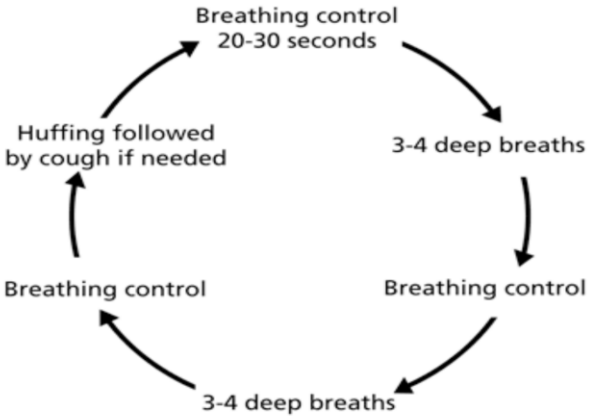
Chest physiotherapy is implemented according to the results that have been achieved from the clinical and functional assessment of both physical and non-physical ability. Assessment of the patient includes identifying the tracheostomy tube that is used and its purpose, for example, if the tube is a cuffed tube, the physiotherapist should be aware that the cuff should be deflated before the therapy session; therefore educating oneself is crucial (Craig Hospital, 2017) Furthermore the assessment includes monitoring patient's breathing pattern, chest movement, the sign of pain, harsh audible breathing, position, colour of the skin, the possibility for swallowing, level of independence, communication, medications of the patients since diuretics and antihypertensive medications cause haemodynamic and fluid changes which affects the patient's tolerance to postural drainage and to the changes in positions, detailed chest assessment, and reviewal of chest x-ray (Rahimi et al. 2013, 248-255; Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

The responsible physiotherapist should assess the indications and the contraindications of the chest physiotherapy in order to set a safe and secure therapy plan. The indications for the chest physiotherapy have been mentioned a few times in this chapter, but contraindications are just as important for a recovering patient (Demers, 1986, 902-903). Contraindications of chest physiotherapy are elevated intracranial pressure, unstable head or neck injury, active haemorrhage or haemoptysis, recent spinal injury, rib fracture, flail chest, uncontrolled hypertension, anticoagulation, and thoracic surgeries (Levine & Stankiewicz, 2020; Osadnik, McDonald, Jones & Holland, 2012, 3).

6.2 Breathing techniques and chest clearance

The initial management phase for the tracheostomised patients includes breathing techniques, chest clearance, positioning, and mobilisation (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398). Breathing technique includes the active cycle of breathing technique (ACBT) which is safe for a tracheotomised the patient. ACBT is a set of breathing cycle that induces sputum clearance from the airways by loosening and moving the sputum. ACBT branches out into four categories that make up the ACBT, which are breathing control, deep breathing, and huffing, and is carried out

while lying or sitting according to the physiotherapist recommendation. This breathing technique is repeated until the patient's chest feel lighter and clear. Picture 6 (Troughton, 2018, 1-8; Keynes, 2011, 1-10) below shows the process of ACBT (Troughton, 2018, 1-8; Keynes, 2011, 1-10).



Picture 6: process of ACBT

6.2.1 Breathing Control

Breathing control is where that requires the patient to breathe gently, using minimum effort as possible using the lower chest with, relaxation of the upper chest and shoulders. The controlling mechanism is a good initiator that strengthens and stimulates the patient's breathing exhaustion and pattern, as well as helps the patient relax between deep breathing and huffing. The whole cycle should be repeated around 10-15 minutes throughout the day. Preforming the ACBT techniques 4-5 times a day is recommended but if the patient has more secretions to clear out, then it is recommended to perform it more often throughout the day. Instruction are shown in table 4 (Troughton, 2018, 1-8; Keynes, 2011, 1-10).

Table 4: Breathing control instructions

Breathing control instructions
Instruct the patient to place the hand on the upper abdomen. Instruct the patient to feel their upper abdomen rise and fall as they breathe in and out (Troughton, 2018, 1-8).

Instruct the patient to breathe in through their nose and out through their nose or mouth depending on their comfortability (Troughton, 2018, 1-8).
Remind the patient to breathe in a rhythmic rate that is comfortable for them, and the rate will slow as they relax (Troughton, 2018, 1-8).

Deep breathing is slow deep breathing with 3 seconds hold with relaxed out breathing, if possible, which helps loosen the secretion. 3-4 deep breaths are recommended at the initial phase. Instructions are shown in table 5 (Troughton, 2018, 1-8; Keynes, 2011, 1-10).

Table 5: Deep breathing exercise instructions

Deep breathing exercise instructions
Instruct the patient to take 3-5 slow, deep breaths in, through their nose, if it is possible (Troughton, 2018, 1-8).
Instruct the patient to pause for 2-3 seconds at the end of each deep breath, then ask them to breath out through their mouth, mimicking the sigh gesture. Remind them to keep their chest and shoulders relaxed (Troughton, 2018, 1-8).
Instruct them to repeat the steps 3-4 times before moving on to the next breathing technique (Troughton, 2018, 1-8).

Huffing uses the stomach and chest muscles to force the breath out. The physiotherapist can instruct the patient to mimic the action of trying to steam the glasses to clean them for the patient to differentiate it from a cough. Huffing will move the phlegm along the airway to the point where the patient can cough it out. Huffing requires less energy to clear out the secretion than a cough. There are two types of huff. Instructions are shown in table 6 (Troughton, 2018, 1-8; Keynes, 2011, 1-10).

Table 6: Huffing instructions

Huffing instructions
Medium volume huff- Instruct the patient to take a normal size breath through the nose and then active, long breath out as if they are trying to steam their glasses to clean until the patient's lung feels empty. Medium volume huff helps move out the secretion that lower in the airways (Troughton, 2018, 1-8).
High volume huff- Instruct the patient to open their mouth wide and huff out quickly. High volume huff helps clear out the secretions in the upper airway (Troughton, 2018, 1-8).
Instruct the patient to perform the huffing techniques 1-2 times together. Otherwise repeated huffing can make the patient tired (Troughton, 2018, 1-8).

The cough should only be performed if there are secretions that are ready to be cleared out. Instruct the patient to listen and feel the crackling sound inside the airways, if the patient hears and feel the sound, then instruct them to cough it out. Remind them to avoid excessive cough as it may reduce the effectiveness of the ACBT technique since coughing can make the patient feel fatigued (Troughton, 2018, 1-8; Keynes, 2011, 1-10).

There are several techniques that can be added with the ACBT technique to improve the effectiveness ACBT. Instructing the patient to hold their breath for about three seconds at the end of one or all the deep breaths, according to their feelings. Another option is where the physiotherapist can add gentle vibrations to the patient's chest while they breath out (Troughton, 2018, 1-8; Keynes, 2011, 1-10).

Chest clearance physiotherapy techniques consist of postural drainage, percussions, vibrations. Furthermore, different mechanisms may contribute in preventing independence secretion clearance; therefore, it is crucial that the physiotherapist in the multidisciplinary team to identify the most relevant problem and correctly selects the inter-

vention to facilitate the sputum clearance. Percussion is one method that the physiotherapist utilises in the intervention (Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

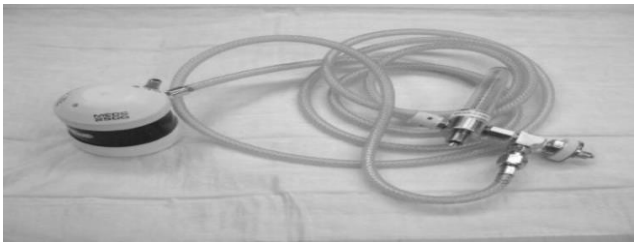
6.2.2 Percussion

Chest percussion is done by rhythmically clapping the cupped hands over the chest wall over the part of the lungs to be drained assist in moving the mucus to the larger airway. The theory behind the percussion is that percussion generates transition flow in airways beneath the percussed area, and it can be added to the postural draining techniques (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). The position of the hand in percussion is the hand is cupped with the palm facing downward, as shown in Picture 7 below (Cystic fibrosis foundation, 2009).

Picture 7: Hand position of percussion technique

Instructions for performing percussion are to vigorously strike the chest wall with alternated cupped hands which should produce a hollow sound. The procedure should not be painful; therefore, monitoring the facial expression of the patient is crucial if the patient is not able to speak. The physiotherapist should be aware of the clothing to avoid performing percussion over buttons which might harm the patient (Pathmanathan, Beaumont & Gratrix, 2015, 20-25; cystic fibrosis foundation, 2009; Reddy, 2015; Toriola, 2015). Contraindications for percussion are bleeding disorders, open wounds, surgeries, and fractured ribs. Percussion over the sternum, spine, and stomach or lower back should be avoided as it causes trauma to the liver, kidneys, or spleen. The recommended percussion time is 30 to 60 seconds several times a day, but if the patient shows signs of tenacious secretions, percussion should be done 3-5 times a day (Reddy, 2015; Toriola, 2015).

Physiotherapist uses mechanical percussion device, shown in picture 8 (Tokarczyk, Greenberg &Vender, 2013, 301-323), to implement percussion sessions as well. The chest percussion device allows the percussion to be performed without the need for cupped clapping which prevents the physiotherapist from getting fatigued and more comfortable for the patient compared to manual percussion.



Picture 8: Mechanical chest percussion device

Newton's third law of motions is used to assist the therapist in controlling the intensity of the percussion. The therapist then controls the intensity of the pulse by how firmly they press the device (Tokarczyk, Greenberg &Vender, 2013, 301-323).

6.2.3 Vibrations

Vibration is a gentle shaking/vibrating movement of the chest to move the mucus to the larger airways so they can be removed by coughing or suctioning (Malcak, Hegde & Herndon, 2012, 239-248). Vibration is performed during the patient's exhalation through pursed lips, and therapist shakes the chest wall by placing both hands, on the appropriate lung segment to be drained. After each vibration session the patient is instructed to cough out the secretions (Reddy, 2015). Positioning of vibration is shown in picture 9 (Cystic fibrosis foundation, 2009).

Picture 9: Hand position of vibration technique

Similar to mechanical percussion device session, vibration can be done by the mechanical device as well since they have been proven to produce good clinical results. Patients who are not able to tolerate percussions prefers the gentle mechanical vibration

sessions as shown in Picture 10 (Malcak, Hegde & Herndon, 2012, 239-248). Manual techniques should be performed every two to four hours for patients with severe retained secretions and it should be continued until the breathing sound improves (Malcak, Hegde & Herndon, 2012, 239-248).

Picture 10: Image of mechanical vibration being performed

Contraindication for vibration are, as for percussion, are bleeding disorders, open wounds, surgeries, and fractured ribs. Percussion over the sternum, spine, and stomach or lower back should be avoided as it causes trauma to the liver, kidneys, or spleen (Reddy, 2015; Toriola, 2015).

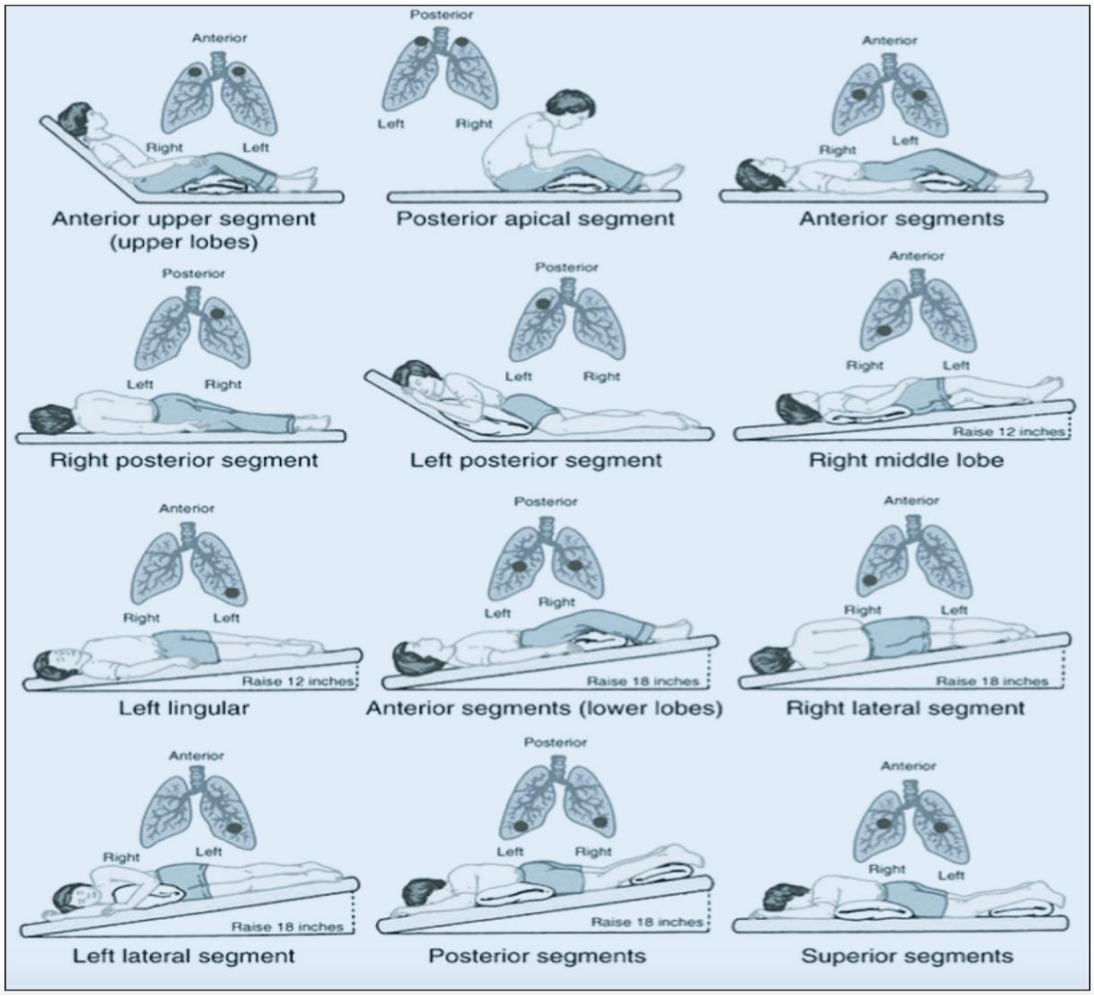
6.2.4 Postural drainage

Postural drainage is a manual technique where patient is instructed and assisted to lay or sit in a different position are thought to stimulate the drainage of secretions from the airways. It utilises the force of gravity to move the secretion to trachea which can be later coughed out; therefore, the goal of postural drainage is to help drain mucus from the lobes into the airways to be cleared. Table 7 below shows postural draining instructions of the lung's segments that are recommended for the therapist to follow and the instructions can be given to other healthcare professionals who can do the postural drainage as well (Lung, 2019).

Table 7: Chart of lower lobes postural draining instruction

Upper Lobes	
Posterior Segment	◦ Patient leans forward 30 degrees over the back of a chair (or in bed). ◦ Vibration and percussion can be performed over the upper portion of the back on either side, if ordered.
Apical Segment	◦ Patient leans backward 30 degrees. ◦ Vibration and percussion can be performed between the clavicle and the top of the scapula on either side, if ordered.
Anterior Segment	◦ Patient lies supine with a pillow under the knees, which enables the abdominal muscles to relax and makes breathing easier. ◦ Vibration and percussion can be performed between the clavicle and nipple of a male patient on either side, if ordered. It may not be possible in a female patient.
Lower Lobes	
Posterior Basal Segment	◦ Patient lies face down on the bed with the pillow between hips. ◦ The foot of the bed is elevated 30 degrees (18 inches). ◦ Vibration and percussion can be performed over the appropriate lobe, if ordered.
Lateral Basal Segment	◦ Patient lies one-fourth turn up from the face-down position on the opposite side of that which is needed to be drained. ◦ The foot of the bed is elevated 30 degrees (18 inches). ◦ Vibration and percussion can be performed over the posterolateral areas of the lower ribs, if ordered.
Anterior Basal Segment	◦ Patient lies straight up on their opposite side of that which is needed to be drained. ◦ The foot of the bed is elevated 30 degrees (18 inches). ◦ Vibration and percussion can be performed over the lower ribs below the axilla, if ordered.
Superior Segment	◦ Patient lies face down on the bed with a pillow beneath the hips. ◦ The bed is in the flat position. ◦ Vibration and percussion can be performed in the middle of the back below the scapula on whichever side is needed, if ordered.
Right Middle and Left Lingual	
Right Lateral and Medial Segments	◦ Same position is used to drain both lobes. ◦ Patient lies one-fourth turn up from the back-down position and a pillow may be placed between flexed knees. ◦ The foot of the bed is elevated 15 degrees (14 inches). ◦ Vibration and percussion can be performed below the right nipple area in a male patient, if ordered. It may not be possible in a female patient.
Left Superior and Inferior Lingual Segments	◦ Same position is used to drain both lobes. ◦ Patient lies one-fourth turn up from the back-down position and a pillow may be placed between flexed knees. ◦ The foot of the bed is elevated 15 degrees (14 inches). ◦ Vibration and percussion can be performed below the left nipple area in a male patient, if ordered. It may not be possible in a female patient.

The procedure of postural drainage is implemented based on the clinical findings of the patient because the patient may not require postural drainage for all the lungs segments. Patients are given medication such as bronchodilator or nebulisation therapy to loosen the secretions; therefore, the therapist should make sure if the procedures are done before beginning the postural drainage sessions to prevent further complications. The therapist schedules postural drainage two or three times daily which depends on the severity of the lung congestion. The recommended periods for the procedure are before the breakfast, before lunch, in the afternoon, and before bedtime. It is advised to avoid the procedure shortly after meals because it induces vomiting and the patient may get tired. Postural drainage is usually is done together with other manual techniques such as percussion and vibration. After the combined procedures, the patient is instructed to cough out the mucus (Lung, 2019; Reddy, 2015).

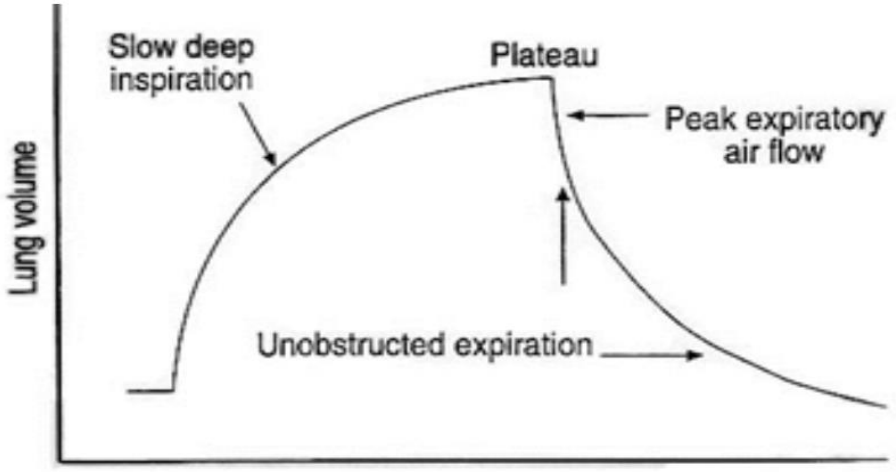


Picture 11: Image of recommended postural draining postures

After the positioning the patient according to picture 11 (Lung, 2019), the therapist instructs the patient to remain in the position for ten to fifteen minutes and it is recommended to follow the patient's facial expressions and colour closely to prevent from inflicting pain or harm to the patient. When the patient is securely positioned the therapist performs percussion or vibration to further induce mucus clearance. The procedure usually follows as positioning, percussion, vibration, and removal of secretion by coughing suctioning. Following the chest physiotherapy, the nurse in the multidisciplinary team steps in to auscultate the lungs of the patient to compare the results to the baseline data and the amount, colour, and the state of expectorated secretion is documented (Lung, 2019; Reddy, 2015).

6.2.5 Manual and ventilated hyperinflation

Manual hyperinflation (MHI), often addressed as bag squeezing, is a manual technique that mimics the physiological aspects of a cough is performed by the physiotherapist in ICU wards for tracheostomised patients as well as other patients with respiratory dysfunction to provide tidal volume (Vt) 100-150% larger than the baseline Vt and peak airway pressure (PAP) no more than 40cmH_2O to the lungs of the tracheostomised patient through resuscitation circuit (McCarren & Chow, 1996, 203-208). MHI assists in moving secretions from peripheral to the central airways to cleared out by the patient coughing it out or suction. Obstructed alveolar is improved by enhanced collateral ventilation and increased transpulmonary pressure utilising MHI (Cruz et al, 2017). Areas of atelectasis is re-expanded by the increase in Vt followed with a slow, deep inspiration continued by an inspiratory pause. Alveoli and collateral airways are encouraged to open. Expiratory flow rate is increased by the increasing the Vt thereby encouraging the elastic recoil of the lungs and chest wall to increase as well. Furthermore, the therapist performs a quick action of releasing the bad which further enhances the expiratory flow. When the rate of the expiratory flow, as shown in picture 12 (Hill, 2018, 1-18), is higher the flow if the inspiratory flow, the secretion clearance is achieved. MHI was developed back in 1968 to optimize oxygenation, clear secretions, and attain alveolar re-expansion. MHI is used in conjunction with positioning of the patient to prevent the collapsed lungs segments from being in a dependent position (Hill, 2018, 1-18)



Picture 12: MHI visual chart

Indication and contraindications for MHI should be followed to prevent to complications. Indications for MHI are poor cough mechanism, retained pulmonary secretions, segmental or lobar atelectasis, and prior to and post endotracheal suctioning. The absolute contraindications for MHI are head injury with ICP > 25mmHg, severe arterial hypotension, nitric oxide ventilation, high frequency oscillation ventilation, high peak end inspiratory pressure (PEEP) ventilation and PEEP dependency, severe bronchospasm, and undrained pneumothorax (Hill, 2018, 1-18).

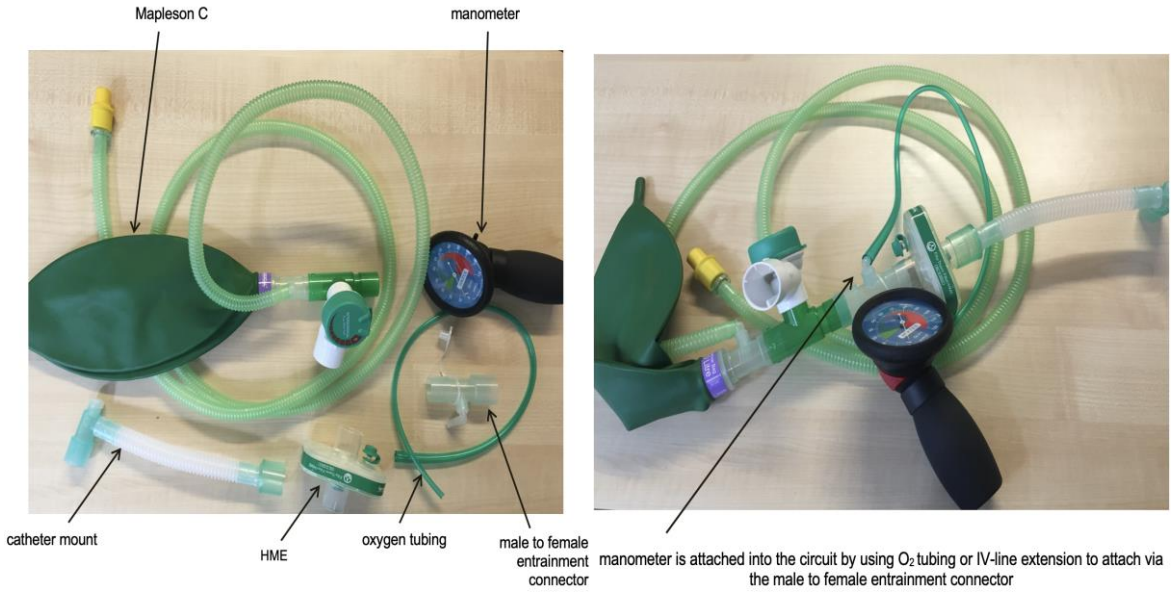
Guidelines for manual hyperinflation according to NHS guidelines put together by Patricia Hills from St George's university hospital respiratory physiotherapy team contain the concise important protocols that are easier to understand and follow. According to the guidelines the proper equipment is important as well. Needed equipment taken from Hills's guidelines is shown in the table 8 below (Hill, 2018, 1-18).

Table 8: MHI required equipment

MHI equipment
2 litre Mapleson-C Anaesthetic Rebreathing System - with O_2 tubing entering the bag proximal to the exhalation valve and with a yellow rubber connector which allows attachment to the flow meter (Hill, 2018, 1-18).

Catheter mount connected to the expiratory port of the bag. (Note: when bagging a mechanically ventilated patient the catheter mount of the ventilator circuit can then be used) (Hill, 2018, 1-18).
O_2 flow metre attached to wall O_2 source / O_2 cylinder (Hill, 2018, 1-18).
Nipple connector to allow connection of the MRB tubing to the flow meter (Hill, 2018, 1-18).
Male to female entrainment connector (Hill, 2018, 1-18).
Manometer (Hill, 2018, 1-18).
O_2 tubing or IV-line extension to connect manometer into circuit via entrainment connector or directly into the Heat Moisture Exchange (H)ME (Hill, 2018, 1-18).

Picture 13 (Hill, 2018, 1-18) below shows the picture of the equipment and how to assemble it as well.



Picture 13: Image of the required equipment and guide on assembling the equipment

Tracheostomised patient requires the resuscitation bag to be attached to the trach using the adaptor that is available before the procedure begins. After the therapist checks and assembles the equipment according to the guidelines as shown on table 5, and picture 13, the procedure begins. Aseptic is a key factor that should be monitored and practised often in the ICU especially while managing tracheostomised patients to avoid further complication such as infection and forming clinical questions based on the indications and performing assessment to further confirm the indication for MHI will ensure patient's safety. Staying in ICU puts stress on the patient's mental health as well; therefore, to prevent adding stress to the patient's mental health, therapist should thoroughly educate the patient on the procedure and talking to the patient throughout to the patient regardless of their ability to speak. Furthermore, thoroughly checking the guidelines will ensure a safety procedure. The guidelines indicate the therapist to pay attention to patient safety throughout the process. The second step contains patient education and explanation to prevent distress to maximise the effectiveness of the treatment. Positioning the equipment carefully is another important step to prevent complication (Hill, 2018, 1-18).

The procedure should be performed in a fluent gesture to optimise the result of the procedure. Listening to audible signs and following the facial expression of the patient gives proper feedback on progress of the procedure. Furthermore, the therapist should thoroughly read and understand the protocols in each step. The steps are putting the patient back on ventilator, monitoring the vital signs during and after the procedure to endure that the parameters have been restored, and recording the results where other healthcare professionals can acquire the information. Communication with the patient about the procedure on aspects of pain, personal thoughts on before and after the procedure, and instructing the patient to inform the healthcare professionals if they feel any different later are vital as well (Hill, 2018, 1-18).

The guidelines have been constructed by Hill et al after systematically reviewing the present, available literature both in medical, nursing, and physiotherapy professions. Furthermore, condition of each patient is different; therefore, the therapist is advised to clinically form question on whether performing MHI is suitable for the patient (Hill, 2018, 1-18). MHI procedure varies across the countries and sometimes within the

country as well, however the goals of assisting the removal of secretions and re-expanding the areas of atelectasis are primary goal everywhere. MHI is popular among the physiotherapist despite the research examining its validity is conflicting since MHI inflicts adverse effect on cardiovascular parameters. Furthermore, apart from uncertainty of MHI effects, studies are not done if effects of MHI depends on the duration of the mechanical ventilation and length of stay in the ICU ward (Paulus, Bennekade, Vroom & Schultz, 2012). Further research and randomised control trials are necessary to examine the safety and effectiveness of application of MHI in intubated and mechanically ventilated patients (Denehy, 1999, 958).

There are several researches that have been done to examine the efficacy and consistency of MHI, however, there is limited evidence that have been published that supports the ventilator hyperinflation (VHI). Despite the case, a recent survey resulted in concluding that 40% of Australians physiotherapists in the ICU wards utilises ventilator hyperinflation. Therefore, a cross-over study with the aim to examine effect of ventilator hyperinflation compared to MHI has been done. Ventilator hyperinflation cleared comparable amount of secretion and was as safe as MHI. The study contains ventilator hyperinflation protocols that can be followed by healthcare professionals and can be utilised to use as research base to further examine its efficacy and consistency. Furthermore, protocols for ventilator depends on the machines that are used as well; therefore, the healthcare professionals who are responsible should know their machines well and follow protocols of the machines (Dennis, Jacob & Budgeon, 2012, 142-9). The therapist or other healthcare professionals are advised to excel in utilising the machine and in understanding the machine optimise the safety of the patient. Furthermore, constantly updating the knowledge on the protocols are important as well (Hill, 2018, 1-18).

6.2.6 Intermittent positive pressure breathing

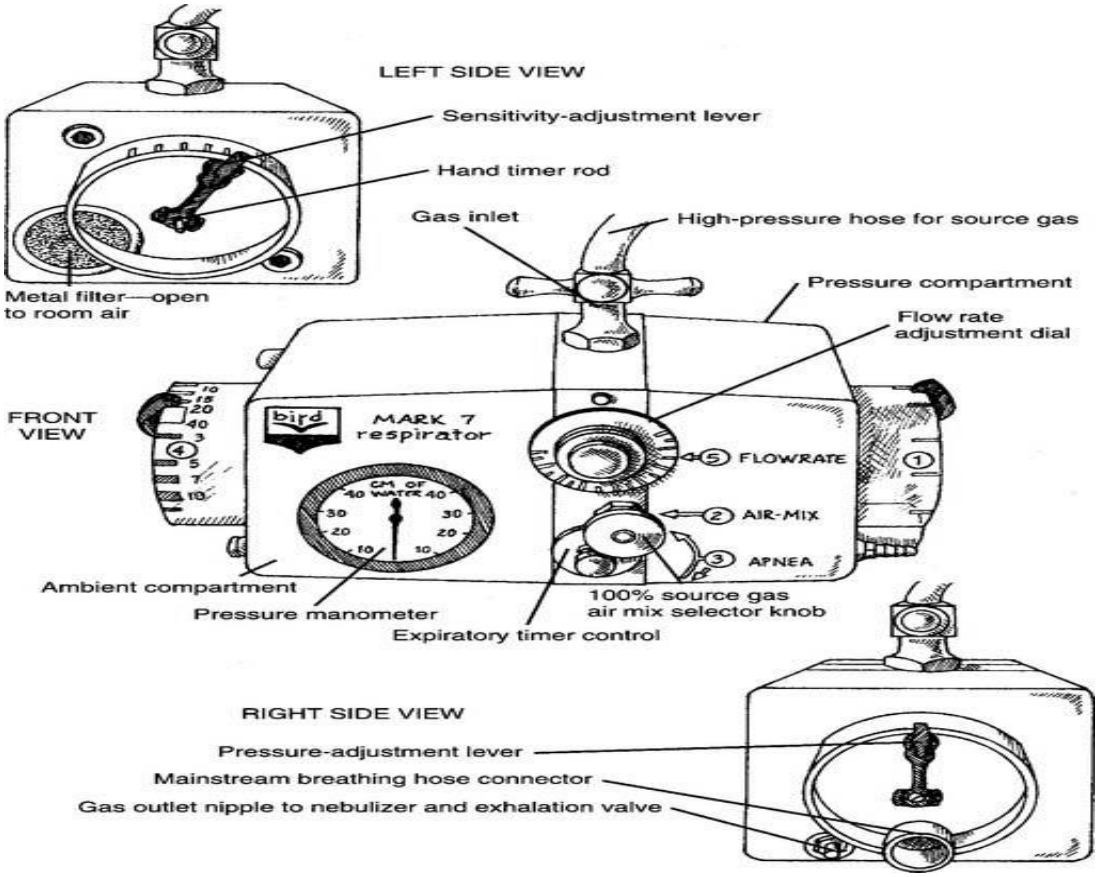
Motely et al, during 1947, introduced the clinical use of intermittent positive pressure breathing (IPPB) technique following the its role in second world war during 1947. IPPB therapy utilises a mechanical respirator to assist the physiotherapist to deliver a controlled pressure of gas to assist in ventilation or expansion of the lungs, thereby

improving lung volume and decrease the work of breathing (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398; Handelsman, 1991, 1-9). The use of IPPB has been controversial among physiotherapist due to the lack of evidence in its efficacy for a physiotherapy treatment but the mutual agreement among physiotherapists on the physiological effect of IPPB enhancing the increase of tidal volume to assist secretion clearance encourage the use of IPPB (Denehy, 2001, 821-829). However, the wide use of IPPB has diminished throughout the years due it's short-lived effects which lasts for about an hour and its long-term consequences has not been adequately evaluated. IPPB therapy used alone or combined with or compared to other modalities show unequivocal clinical effectiveness in terms of morbidity, mortality, or lung function. In general, IPPB therapy has not been proven to show any superiority or efficacy compared to other modalities. However, IPPB therapy may be useful to patients who failed to respond to standard and simpler therapies such as postural drainage, to patients who are at risk of respiratory failure due to decreased respiratory function, and to patients with acute severe bronchospasm who fail to respond to standard therapy. Thereby, the American Association for Respiratory Care (AARC) recommends the use of IPPB only for patients with atelectasis and emphasises on the fact of short-term effect. However, IPPB therapy is still widely used combined with other modalities such as cough assist devices that can attach to the trach for tracheostomised patients (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398; Handelsman, 1991, 1-9; Denehy, 2001, 821-829).

Contraindication for IPPB therapy are mostly relative. Physiotherapist are recommended to practise a clinical questions-based assessment to identify the contraindications as it may a secondary factor that may cause complications. According to AARC, 2003, tension pneumothorax (untreated), haemodynamic instability, recent facial, oral or skull surgery, nausea, active haemoptysis, air swallowing, singulation, radiographic evidence of bleb, recent oesophageal surgery, and intracranial pressure (ICP) >15mm Hg are contraindications for IPPB therapy (Respiratory care, 2003, 540-546).

Commonly used IPPB devices are the bird as shown in picture 14 (Respiratory care, 2003, 540-546), Puritan Bennett (PB) IPPB therapy unit, Draeger breathing system, and Piper breathing system. The IPPB devices requires some conscious effort from the patients for IPPB device to assist the patient breathe in the appropriate airflow into the

lungs, when the patient reaches the appropriate airflow, the IPPB device will exert positive pressure to sustain the airflow, then the IPPB device will allow you to breathe out passively. AARC recommends that for lung expansion therapy a minimum delivered tidal volume of at least 1/3 of the predicted inspiratory capacity (1/3 x 50 mL/kg) (Respiratory care, 2003, 540-546).



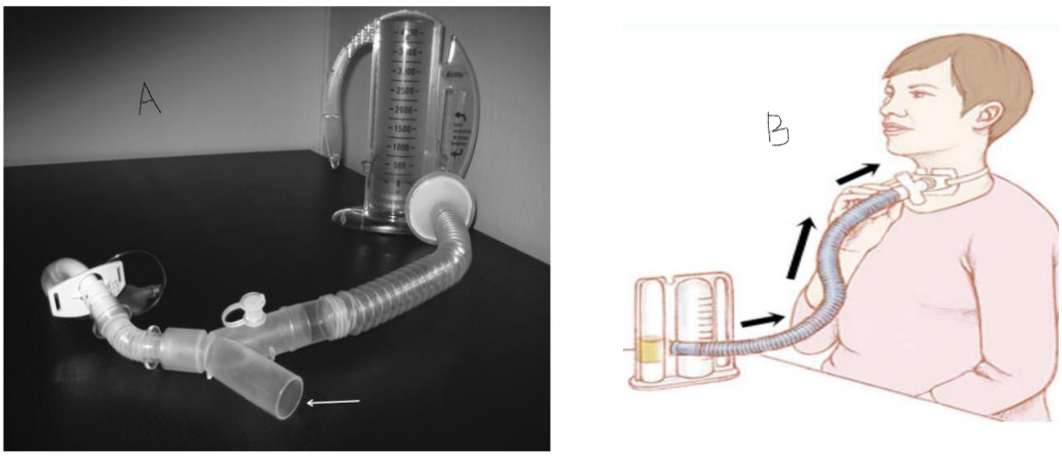
Picture 14: IPPB bird device illustration

In general, the evidence of IPPB therapy efficacy and its consistency for tracheostomised patients is still lacking. Thereby further studies should be done. However, IPPB treatment is still practiced worldwide, thereby, it is recommended for a physiotherapist working in the ICU to be familiar with the process (Handelsman, 1991, 1-9; Denehy, 2001, 821-829)

6.2.7 Incentive spirometry

Incentive spirometry is used for tracheotomised patients to prevent and manage atelectasis. Tracheostomised patients undergo postoperative disturbances in lung function because of prolonged inactivity, pain that prevents the patient from aiding with therapies, or chest wall deformity from various surgical procedures. The studies that have been done on the use of incentive spirometry for tracheotomised patients supports the convenience and safety of using customised incentive spirometer (Tan 1995, 292; Goldstein, Iloreta & Malkin, 2012, 1065).

Incentive spirometry, shown in picture 15 (Mount Nittany Health, 2016), is beneficial to patients as it provides visual feedback in flow and volumes which serves as motivating factor as well. The visual feedback allows the patient to carry out the procedure individually without supervision as well. The device is handheld, lightweight and portable, and allows to be used to enhance other breathing techniques such as deep breathing or ACBT. Studies suggests that regular use of incentive spirometer allows the patient to acquire their goal for using the device which are increased lung volume, enhanced respiratory function, and decreased secretion retention. Patient education is required before the individual practise of the device (Tan 1995, 292; Goldstein, Iloreta & Malkin, 2012, 1065).



Picture 15: (A) assembled spirometry for tracheostomised patient. (B) demonstration on how to attach the spirometry

Using tracheotomy incentive spirometer is an easy task for both the physiotherapist and the patient as well. It is always advised to start the procedure by sterilising the device to prevent infections (Goldstein, Iloreta & Malkin, 2012, 1065). Table 9 (Mount Nittany Health, 2016) below contains the instruction for using incentive spirometer for tracheostomised patient (Mount Nittany Health, 2016).

Table 9: table of incentive spirometry instructions

Instruction for using incentive spirometer for tracheostomised patients
Step 1: Instruct the patient to fit the T- piece on the tracheostomy tube and breathe normally. The presence of T- piece makes it easier for the patient to breathe through your trach tube (Mount Nittany Health, 2016).
Step 2: Instruct the patient to breathe normally. Calmly instruct them to relax and breathe out (Mount Nittany Health, 2016).
Step 3: Ask the patient to breathe in slowly and deeply and to inhale as much as air as possible. Instruct them to follow the indications on the spirometer to see if the patient is breathing too fast and if the patient is breathing too hard ask them to breathe in more slowly (Mount Nittany Health, 2016).
Step 4: Instruct the patient to hold their breath long enough to keep the balls inside the spirometer raised for at least 3 seconds (Mount Nittany Health, 2016).
Step 5: Instruct the patient to perform the procedure once every hour or as the physiotherapist prescribed (Mount Nittany Health, 2016).
Step 6: Instruct the patient to finish it with ACBT or deep breathing technique with coughing mechanism to enhance the mucus clearance (Mount Nittany Health, 2016).

According to Goldstein et al, the incentive spirometer has positive effect on treatment through visual feedback. The device's safety, being affordable, and easy to use have allows it to be used in most hospitals worldwide. Most studies have shown its efficacy and consistency in effective treatment outcomes for tracheostomised patients (Goldstein, Iloreta & Malkin, 2012, 1065).

6.2.8 Suction

The purpose of tracheotomy suction is to remove secretion from the trachea and lower airway tract that the patient is not able clear themselves. Physiotherapist administers suctioning in the morning and at night before the patient goes to sleep. Suctioning is administered after any other respiratory treatment as well. Indications for suctioning are often patient having moist cough that does not assist in mucus clearance and having breathing difficulty due to not enough gas exchange. Suctioning should not cause pain but the patient feeling short of breath and coughing are normal reaction to suctioning. Contraindications for suctioning is not present, however the risks are associated with the process of suctioning. Therefore, suctioning is advised to be administered as per individual needs of a patient (Sinha & Fitzgerald, 2020).

The process needs equipment which are oxygen source, vacuum source, suctioning machine, stethoscope, calibrated and adjustable regulator, connecting tubes, suction catheter, gloves, distilled water, paper cup, and clean basin. Physiotherapists are advised to pay attention to having their personal protective gears which includes gowns, gloves, mask, and sometime goggles. Suctioning contains two systems which are open and closed. Open suctioning is when single-use catheter that is inserted through open end of the tracheostomy tube, whereas closed suctioning involves using the same catheter multiple times. Closed suctioning is useful when the patient is connected to a ventilator due to the nonrequirement of constant disconnection of the circuit. Size of the catheter is important aspect of the procedure as well. if the size of the catheter is bigger compared to the patient's trach tube, then the suction will inflict damage. It has been recommended to use catheter half the size of the trach tube for optimised suctioning (Sinha & Fitzgerald, 2020; John Hopkins Medicine, 2019).

There are absolute protocols for suction frequency. The frequency is decided by the physiotherapist who is administering the therapy considering that facts which are the patient's ability clear mucus themselves. Administering suctioning once per eight hours is recommended by National Tracheostomy Safety project (NTSP). Depending on where the secretions are located shallow and deep suctioning is done (NTSP, 2013). Analgesia is done by the nurses in countries like Finland, therefore involvement of

multidisciplinary team is needed (Suomen Fysioterapetutit, 2018). Table 10 (NTSP, 2013) below contains the instruction for suctioning that has been taken from NTSP.

Table 10: Table of instruction for suctioning

Action	**Rationale**
Explain the procedure to the patient	Relieve patient anxieties
Consider analgesia prior to or following suctioning	Suctioning can be a painful procedure
Switch suction unit on and check that the suction pressure on circuit occlusion does not exceed-150 mm Hg or 20kPa pressure	To ensure the machine is working correctly. Too great a suction pressure can cause trauma, hypoxaemia and atelectasis
Wash hands, put on gloves, apron and goggles	Reduce the risk of cross infection
Ensure that an appropriate non-fenestrated inner tube is in place	Larger fenestrations allow the suction catheter to pass through, causing trauma to tracheal wall or giving the false impression that the catheter will not pass
Consider pre-oxygenation if receiving oxygen or ventilated	To prevent hypoxaemia
Remove tracheostomy devices prior to open suctioning	To allow access for sterile suction catheter tip
Connect suction catheter keeping catheter tip covered (sterile)	To reduce the risk of transferring infection from the hands to the suction tubing.
Place top ‘double’ glove on dominant hand	To aide removal and replacement of fresh gloves per each suction episode
Do not apply suction whilst introducing the catheter, or push against resistance at any time	Suctioning while introducing the catheter causes mucosal irritation, damage & hypoxia
Occlude suction port with gloved thumb and suction on removal of suction catheter (no need to rotate on removal as catheters have circumferential holes)	Prolonged suctioning can result in hypoxia and trauma
Period of suction should not exceed 10 seconds	To reduce risk of mucosal damage and hypoxaemia
Suctioning should be continuous not intermittent	Intermittent suctioning does not reduce trauma and is less effective

Observe the patient throughout the procedure to ensure their general condition is not affected.	Tracheal suction may cause vagal stimulation leading to bradycardia, hypoxia and may stimulate bronchospasm
For patients requiring oxygen therapy, reattach O_2 within 10 seconds.	To limit hypoxia
Remove the glove from the dominant hand by inverting it over the used catheter & dispose clinical waste bag	To minimise the risk of infection
Assess the patient's respiratory rate, skin colour and/or oxygen saturation to ensure they have not been compromised by the procedure and determine if they need further suction.	Suction should be performed only when needed and not as part of a routine, so that damage to the trachea is avoided
It is recommended that no more than 3 episodes of suctioning are carried out in succession	To limit side effects and maximise recovery period
Difficulties in suctioning tenacious mucus may be due to inadequate humidification. Try a more effective humidifier. Consider use of nebulizer, mucolytics and concurrent physiotherapy. Saline instillation may be useful in some situations such as deep bronchial suction and bronchial lavage.	
If O_2 delivery was increased, review for return to previous level.	To prevent unnecessary oxygen delivery
Flush through the connection tubing with the clean water. Empty water receptacle and ensure this is ready for further use. Wash hands.	To minimise the risk of infection
If the patient needs further suction, repeat the above actions using new glove & a new catheter	

Thus, the physiotherapist who administers and performs the suctioning is advised to choose the correct pressure to balance the effectiveness of suctioning and to prevent further complications. Effective pressure that is recommended range from minimum of -88mmHg to -300mmHg. Studies show physiotherapists mostly prefer administering pressure no more than -150mmHg (NTSP, 2013).

6.2.9 Mechanical cough assist

Tracheostomised patients may lack the strength to initiate the cough reflex which is required to clear the secretion. Prolonged inactivity and muscles weakness after surgery contribute to in inhibiting the cough reflex mechanism, thereby secretions build-up in the airways, breathing becomes a difficult task, and possibility for respiratory

infection arise (Guérin et al, 2014, 1108-1114). Mechanical cough assist machines are used by the therapists when the need arise to stimulate the cough mechanism. According to pulmonary critical care physician Joshua Benditt, MD, the cough assist procedure is more comfortable to a tracheostomised patient compared to other procedure that are invasive such as inserting catheters into the airways which can place stress on a patient (Spear, 2019; Sancho, Servera, Vergara & Marin, 2003, 750). These machines are known by the name mechanical insufflator-exsufflators (MI-E) which utilise positive pressure to enhance maximal lung inflation and the physiotherapist follow this be a rapid switch to a negative pressure. The rapid change allows the production of high expiratory flow rate to stimulate a strong cough that clears the secretions. This technique is used by the physiotherapist to maintain lung compliance, thoracic rib cage mobility, and length of respiratory muscles of the patients (Pathmanathan, Beaumont & Gratrix, 2015, 20-25). Peer- reviewed journal Respiratory Care contain research that has been published that shows that combination of mechanical cough assist and respiratory physiotherapy provided a good result in a clear airway compared to only administering respiratory physiotherapy (Terzi, Héléne & Lofaso, 2018 1577-1578). However, all the safety measures should have been met before administering the mechanical cough assist therapy Contraindications for administering mechanical cough assist are undrained pneumothorax, flail segments, and significant cardiovascular instability (Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

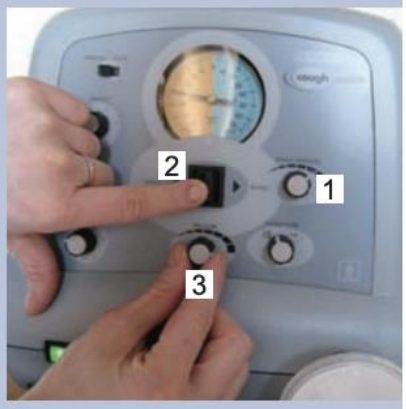
The study done by Guérin et al in year 2011 concluded that the artificial airways had a major reduction of peak expiratory flow (PEF) during the mechanical insufflation-exsufflation. Thereby, to achieve the suitable PEF in patient with tracheostomy, the pressure that the physiotherapist administers should be increased. They have also stressed the fact that suctioning should always be part of the treatment to avoid accumulation of missed secretion in the ventilator circuit or at the deep end of the artificial airway (Guérin et al, 2014, 1108-1114).

Setting up the Cough Assist

Setting the pressure

Block off the end of the tubing.

1. *Set the inhale pressure to full.*
2. *Push the manual control lever to exhale.*
3. *Turn the pressure button until the desired exsufflation pressure is reached.*



Setting the inhale pressure lower than the exhale pressure

Block off the end of the tubing.

1. *Push the manual control lever to inhale.*
2. *Turn the inhale pressure button until the desired insufflation pressure is reached.*

Setting up automatic mode

Set the device as previously described.

1. *Set the inhale time to the desired time in s.*
2. *Set the exhale time to the desired time in s.*
3. *Set the pause time to the desired time in s (i.e. the amount of time to rest between insufflation and exsufflation cycles).*
4. *Set the switch to automatic.*

Setting inhale flow full or reduced

1. *The inhale flow button allows a decreased inhale pressure to be delivered.*

Picture 16: MI-E setting instructions

The instruction to administering the MI-E to the tracheostomised patient is began by setting up the machine correctly as shown in picture 16 (Chatwin, 2008, 320-329). Further instructions are shown in table 11 below (Chatwin, 2008, 320-329).

Table 11: instruction to administer MI-E

Instruction for administering MI-E
Connect the tube to the trach first and explain the procedure to the patient Strat the positive pressure (insufflation) at 15-20 cmH2O (1.5-2.0 kPa) and increase to give an inspiration n to total lung capacity. Sometimes the therapist may require increasing the positive pressure as high as 40 cmH2O (3.9 kPa). It is recommended that the insufflation should last about 2 seconds, or longer if required.
Start with the negative (exsufflation) pressure simultaneously with insufflation pressure the increase the exsufflation to 10-20 cmH2O (1.0-2.0 kPa) above the insufflation pressure. Exsufflation pressure is held for abut 3-6 seconds, stimulating the cough mechanism. The indicator for the treatment efficacy is the increase in the sound of the cough. Listen to the audible signs.
The patient will adjust to coordinate their cough when the device switches to exsufflation. Inform the patient of a coming deep breath and instruct them to cough as they feel the negative pressure.

The MI-E machines come with both automatic and manual setting. The physiotherapist often manually sets the machine and switches to automatic mode to ensure safety. Physiotherapists are advised to spend time in getting to know the machine thoroughly to avoid further complications (Chatwin, 2008, 320-329).

6.3 Mobilisation and strengthening

The European Society of Intensive Care Medicine recommends that active or passive mobilisation and muscle training should be administered as early as day one and the physiotherapist should be responsible for implementing therapy plans which includes exercise prescriptions as well. Physiotherapists are responsible in informing the other healthcare professionals about the therapy plan in order to work together to optimise the recovery (Gossleink et al, 2008, 1188; Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

Bed rest and prolonged inactivity are the major problems for tracheostomised patients due to prolonged stay in the ICU ward. According to the study that has been done by

Martin et al, patients who are mechanically ventilated and immobilised are weak and deconditioned but they have responded positively aggressive whole-body and respiratory muscles training which significantly improved strength, reduction in length of stay in the ICU, weaning outcome, and functional ability. Therefore. Whole-body rehabilitation should be administered in conjunction with other therapies (Martin, Hincapie, Nimchuk, Gaughan & criner, 2005, 2259-65).

Mobilisation and strengthening programmes included evaluation of patient's current condition which can be assessed by manual muscles strength assessment, Barthel index of Activities of daily living (BI), functional independence measure (FIM), and range of motion (ROM). Table 11 (Martin, Hincapie, Nimchuk, Gaughan & criner, 2005, 2259-65) below contains the example of mobilisation and strengthening intervention. The interventions should be tailored considering their needs, goals, and condition, thereby the physiotherapist is responsible for prioritising mobilisation and strengthening interventions (Zafiropoulos, Alison & McCarren, 2004, 95-100; Chiang, Wang, Wu C, Wu H & Wu Y, 2006, 1271-81).

Table 11: example table of mobilisation and strengthening

Mobilisation	Strengthening
Early mobilisation includes ankle pumps, passive leg raises and other leg exercises while supine, and active and passive arm exercises while supine and sitting.	Strengthening administered with mobilisation. Active leg and hand exercises raises while supine and sitting.
Positioning included going from supine to sitting, sitting to sitting over the edge of the bed, and sitting over the bed to standing. As the patient improved more complex positioning and transferring was administered.	Walking on the spot for a minute or two, heel raises while standing, and pelvic tilts, bridging, and chair exercises.
Shoulder rotations, wrist rotation, and other joint rotations	Walking able distance with the oxygen ventilator attached

Respiratory Muscles Training (RMT) is where techniques and exercises are utilised to improve the respiratory muscle function. RMT includes Inspiratory Muscle Training (IMT) combined with Expiratory Muscles Training (EMT). RMT improves breathing effort, whole body effort, breathing patter, heart rate, oxygen uptake, gas exchange, and fatigue. Interventions such as ACBT, deep breathing, breathing through straw, breathing into water, and incentive spirometry are used for RMT. Inspiratory pressure threshold loading (IPTL) is commonly used among the physiotherapist via devices such as manometer. RMT is administered after assessing the patient for maximal respiratory pressure (MIP) and peak inspiratory and expiratory flow rate to create a baseline to evaluate the effectiveness after the therapy sessions (Aliverti, 2016, 165-168)

Tracheostomised patients also receive resistance and endurance RMT through the closing of the trach pipe where the patient is instructed to breathe through the nose. This is done for a minute initially, then as the patient improves the time off the ventilator, it is slowly increased to improve endurance and resistance. Physiotherapist then instructs the patient then doing exercises without the assistance of the ventilator. This is called weaning off process as well. Walking on and off ventilator is administered, as the patient's condition improves further, to strengthen and mobilise further. The process of removing the tracheostomy is done in conjunction with the results acquired from other healthcare professionals (John Hopkins Medicine, 2019; Pathmanathan, Beaumont & Gratrix, 2015, 20-25).

Picture 17: image of walking tracheostomised patient

Journal published by Winck and colleagues stress the importance of administering walking for tracheostomised patients, as shown in picture 17 (Winck, Camacho & Ambrosino, 2010, 334-340), to improve strength which encourages the weaning off process and patient recovery. Therefore, responsible physiotherapist is advised to tailor an intervention towards prevention of prolonged stay in the ICU and with mechanical ventilator which encourages patient recovery (Winck, Camacho & Ambrosino, 2010, 334-340). Assessing when to decannulate a patient is complex, and the role of the physiotherapist is pivotal for this procedure. Responsible physiotherapist should remember that results pf PEF or PCF alone are not only the factors that should be relied on to decannulate a patient successfully. Input of the multidisciplinary team on need for ventilatory support, secretion management of both oral and pulmonary, swallowing skill, and the underlying medical conditions are vital to start the decannulation, thereby the physiotherapy should work in conjunction with other healthcare professions to identify and manage important aspects that the patient needs to be managed (Bonvento, Wallace, Lynch, Coe & McGrath, 2017, 391-398).

7 EVALUATION OF EFFECTIVENESS OF TREATMENT

Evaluating the effectiveness of the administered interventions are pivotal to determine patient for patient recovery and to be discharged from the ICU ward. Effectiveness of the treatment is evaluated by comparing the baseline results to the current results of the patient, patient interview, and team meetings with the multidisciplinary team (NICE, 2009, 1-92)

Achieving the goals that have been set in the beginning of the procedure is an important aspect of evaluation the effectiveness of the treatment. Determining the efficacy of the treatments is fundamental to the physiotherapist to monitor the patient's current condition. It assists the physiotherapist to tailor a suitable intervention for the patient (NICE, 2009, 1-92).

8 THESIS METHOD AND PROCESS

This is an informative thesis which is written with the aim of providing the student with study materials on physiotherapy interventions for tracheostomised patients. The information was combined from articles, journals, books that are evidence- based and relevant to the topic. More than twenty articles, studies, journals, and two books were used as the method of the thesis. Materials were gathered through scientific platforms such as PubMed, Cochrane, and other journal platforms. Gathering the information and differentiating its relevance took a month. The reason for choosing this method was because gathering information through the studies published as journals or articles provided accurate information for the thesis with the aim of providing information for other students. The thesis then progressed with the students that will be reading the materials in mind in order to avoid over loading and the author have mostly included methods that are used by physiotherapists in Finland. Overall, it took about 3 months to complete the thesis and to put together the study materials.

9 IMPLEMENTATION OF STUDY MATERIALS

Study materials are be provided to students through a website platform that the author has created. The materials include PowerPoint slides, articles, books, and quizzes in order to keep the students engaged. The author created the website through available website templates that have been provided by safe source. The link to the website will be added in SAMK's Moodle where the students can access the materials. The website is sectioned into introduction, overview, quizzes and sources. The author will update the website occasionally to ensure that the information provided stays up to date. Quizzes section will be updated as well in order to keep the students engaged. The link to the website is given to the teachers who can add the link to the SAMK's Moodle platform, and it is provided below as well.

Link to the website: tracheostomy-guide.squarespace.com
Password: SAMK2020

10 DISCUSSION

The importance of administering early physiotherapy interventions for tracheostomised patients are evident. The increasing studies that are being performed the efficacy of physiotherapy interventions have created a strong awareness among the healthcare professionals. The treatments that are administered by physiotherapists vary between countries but the main goal of improving the quality of life of the patients is the focus among the physiotherapists everywhere. The main interventions that the physiotherapists focus on are improvement of respiratory care, mobilisation and strengthening, and functional ability to prevent further complications and to improve the quality of life. The efficacy and consistency of the interventions that are provided for the tracheostomised patients shows the need that it should be studied further. The lack of evidence of interventions that are tailored mainly towards the tracheostomised patients leads to generalised physiotherapy interventions rather than individualised interventions. Thereby, further development is needed to identify the best methods that are suitable for tracheostomised patients as well as improvement in staff education who are treating tracheostomised patients is needed.

Upon researching about this topic, the author mostly came across ICU generalised physiotherapy interventions that are administered to tracheostomised patients. Evidence for treating tracheostomised patient are just limited to respiratory care again with general focus as well. Efficacy and consistency of the interventions are greatly lacking. There are several references that are old as well, but the author has included them due to the fact that there are no other studies that have been done to assess their efficacy. The majority of the evidence that the authors has gathered are from articles, journals, and books. However, there are some evidence-based treatments that the author has found which are included in the treatment section of this thesis. Furthermore, more studies need to be conducted to provide the optimal care for tracheostomised patients.

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