

Review Article

A Practical Physiotherapy Approach in Intensive Care Unit

Manivel Arumugam¹, Murali Thangaraj², Baskaran Chandrasekaran³, Ramanathan Palaniappan Ramanathan⁴,
Pauline Kiruba Priyadharshini⁵, Pitchaimani Govindharaj⁶

¹Senior Physiotherapist, ⁴Professor and Head,
Department of Pulmonary and Critical Care Medicine, PSG Hospitals, PSG Institute of Medical Sciences and
Research, Coimbatore, Tamil Nadu, India.

²Associate Professor, Department of Critical Care Medicine, PSG Hospitals, PSG Institute of Medical Sciences
and Research, Coimbatore, Tamil Nadu, India.

³Assistant Professor, Department of Exercise Physiology and Sports, School of Allied Health Sciences, *Manipal*
University, Manipal. Karnataka, India.

⁵Senior Physiotherapist Department of Physical Medicine and Rehabilitation, PSG Hospitals, PSG Institute of
Medical Sciences and Research, Coimbatore, Tamil Nadu, India.

⁶Lecturer, Department of Allied Health Sciences, Sri Ramachandra Institute of Higher Education and Research,
Porur, Chennai, Tamil Nadu, India.

Corresponding Author: Manivel Arumugam

ABSTRACT

Intensive care unit (ICU) is the most required area to treat patients who admitted for an unconscious, cardiopulmonary arrest, drowning, poisoning, cerebrovascular accidents, acute post-operative surgery patients etc. for improving their health with various treatment procedures. Physiotherapy is one of the treatment procedures in inside the ICU to regain the patient's mobility and stability with the use of procedures such as chest physiotherapy, range of motion exercises and early mobilization activities to be used to improve functional capacity, strengthening the muscles with continuous rehabilitation would improve quality of life among patients admitted to respiratory and medical ICUs. In order to practice in the ICU, this study aimed to review the planning and implementation methods of physiotherapy in the area of critical care to suggest the physiotherapy protocol. Initiation of this protocol based assessment and implementation of physiotherapy inside the ICU is safe and beneficial while practiced with good team members. Our views may differ with other national practices, but it is easier to practice with simplest ideas and planning which we currently practicing in our domain. It is useful for the newcomer in ICU team for making effective treatment.

Key words: Physiotherapy, Early Mobilization, Airway clearance, Breathing exercise.

INTRODUCTION

Intensive care unit (ICU) is the most required area to treat patients who admitted for unconscious, cardio pulmonary arrest, drowning, poisoning, cerebrovascular accidents, acute post-operative surgery patients etc. for improving their health with various treatment procedures. Physiotherapy is one of the treatment procedures in inside the ICU to regain the patient's mobility and stability with the use of procedures such as

chest physiotherapy, range of motion exercises and early mobilization activities to be used to improve functional capacity, strengthening the muscles with continuous rehabilitation would improve quality of life among patients admitted to respiratory and medical ICUs. ^[1]

In Indian scenario most of the ICUs doesn't have physiotherapist team to give treatments in critical care settings, and also if available, they weren't practice regularly

in ICU for the whole day, not in a proper planning in making decisions regarding assessment and treatment and documentation. [2] In order to practice in the ICU, this study aimed to review about the planning and implementation methods of physiotherapy in the area of critical care for to suggest the physiotherapy protocol.

Physiotherapy assessment of critically ill patients is directed to deficiencies at a physiological and functional level and less by the medical diagnosis. Accurate and valid assessment of respiratory conditions, deconditioning and related problems is of paramount

importance for physiotherapists. [3] In addition, physiotherapists can contribute to the patient's overall well-being by providing emotional support and enhancing communication. For better planning and implementation there is a need of good team members like pulmonary physician, intensivist, physicians for specialized condition, surgeons, ICU physiotherapist. These team member roles were explained in **Figure.1**. According to the need other team members of the ICU like Nurses, perfusionist, respiratory therapist can also included in planning and implementation of treatment in ICU.

Figure.1: Organogram

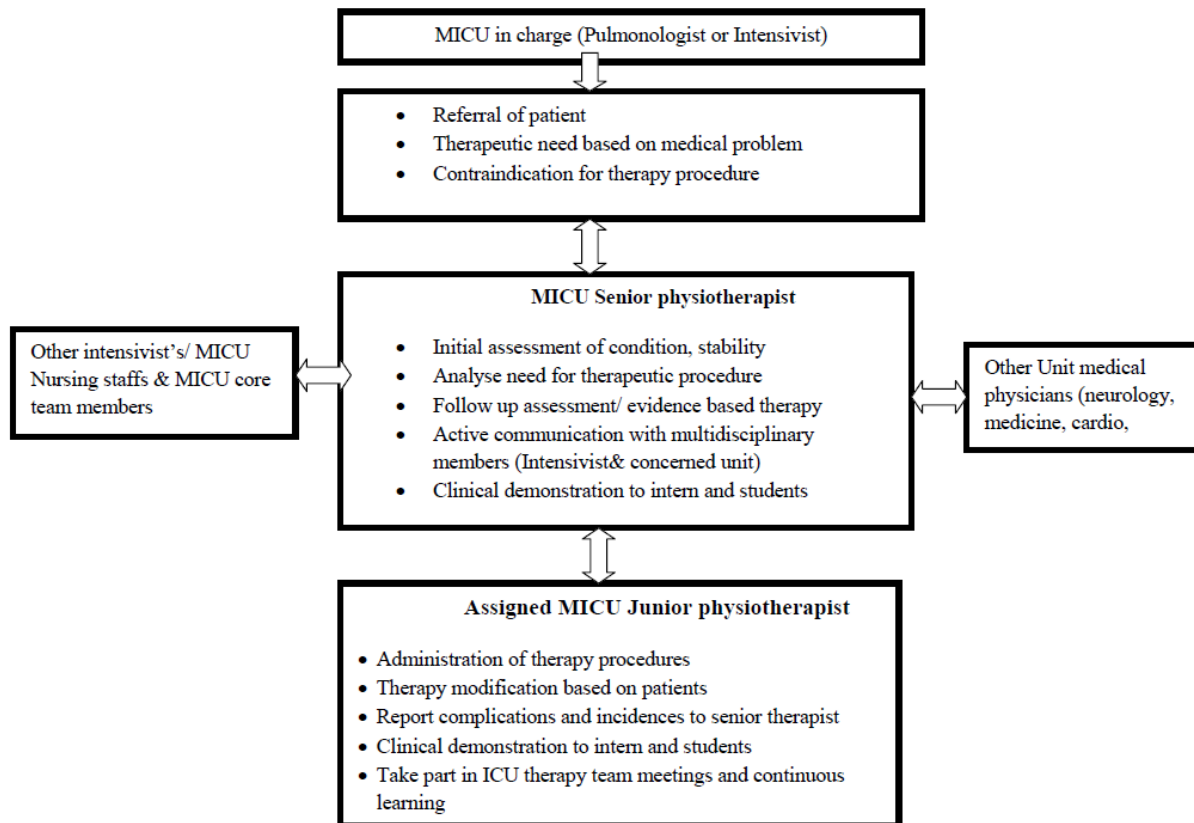


Figure.1: Organogram

AIMS AND GOALS OF INTENSIVE CARE PHYSIOTHERAPY

Aims and goals of intensive care physiotherapy are;

- To aid in airway clearance on need and on – call.
- To decrease complications of immobility (DVT, pressure sore).

- To decrease symptoms such as pain, breathlessness and make mobility in ease.
- To decrease anxiety, depression associated with ICU monitors, tubes, isolation and related delirium, to increase chances of early liberation from



mechanical ventilation through early mobilization, exercise, etc. [4]

- To facilitate early out of bed (pertained to primary ailment) and promote functional independence, to monitor for foreign tubes (Endotracheal, Foley's and ICD) during techniques, to maintain good rapport with ICU team members for effective therapeutic care.

ASSESSMENT PEARLS

Initial assessment shall be based on medical records and history from the patient if conscious or attender if patient in ventilator or unconscious. The ICU physiotherapy record sheet was showed in **Table.1** and therapeutic assessment and outcome measures are described in

Table.1: ICU Physiotherapy Record Sheet

Name:	Age:	IP No:	Date of admission	Date of assessment:
Bio hazard: Y N	Isolation: Y N	Diagnosis:	Present complaints:	
History:			ECMO: Y N	
Monitor: RR:	T:	BP:	HR:	SpO2: (FiO2 Mode: V RA NC FM NIV) ECG:
Examination:				
Observation	Palpation	Percussion (*)	Auscultation	
Built?	Bony contour?			*Crepes
Distress?	Tracheal deviation?			Δ Wheeze
Tubes? ICD, tracheostomy	Diaphragm			× Rales
Mobility				
Higher functions:	GCS	Muscle Power	Others	
Mobility functions	Independency?	Walking aids?	Transfers	Bathing /Toilet
Musculoskeletal problems:			Urinary problem:	
Mechanically ventilated	Y /No	If yes, Ventilatory parameters:	Mode	FIO2 PEEP PS
Drugs	Vasopressors	Anticoagulants	Bronchodilator	Mucolytes:
<i>Problem List</i>	<i>Airway clearance</i>	<i>Breathlessness</i>	<i>Functional incapacity (ventilator weaning)</i>	<i>Poor MICU coping/ Ventilation liberation</i>
Physiotherapy management plan	<ul style="list-style-type: none"> ➤ Postural drainage and suctioning ➤ ET/Tracheostomy tube care ➤ Ventilation humidification ➤ Steam inhalation ➤ ACBT ➤ Discuss regarding mucolytics 	<ul style="list-style-type: none"> ➤ Positioning ➤ Relaxation techniques ➤ Purse lip breathing ➤ Aerobic/ resistance for quadriceps and scapulothoracic muscles ➤ Passive techniques (trigger, myofascial) ➤ Breathing exercises 	<ul style="list-style-type: none"> ➤ Inbed strengthening ➤ Oxygen titration during activities ➤ Chair sitting ➤ High sitting in bed ➤ Standing with / without walker ➤ Walking prescription ➤ Pressure sore and DVT 	<ul style="list-style-type: none"> ➤ Diet – normal, tube ➤ Inbed strengthening and early mobilisation ➤ Rapport with attenders during physio session ➤ Social activities ➤ Oxygen titration ➤ Humidification

System wise assessment shall be carried (for e.g., if neurologically impaired, reflexes, higher functions and functional independence, if cardiac, murmurs and functional ability), If patient in invasive ventilation, the ventilator modes, pressures pertained to the primary pathology, mobilization criteria, termination of mobilization (after discussion with ICU intensivist's team), the weaning ability and contraindications to physiotherapy as decided by senior physiotherapist. Assessment of RT feeding tube, Foley's catheter, PEG feeding tube, Vasopressors support, Infusion pump tubing, real time monitor (ECG, Pulse Oximeter) chords, CUP monitor tubes shall be done prior to mobilization. Mobilization criteria shall be strictly followed based on scale, Chest physiotherapy on need and on call.

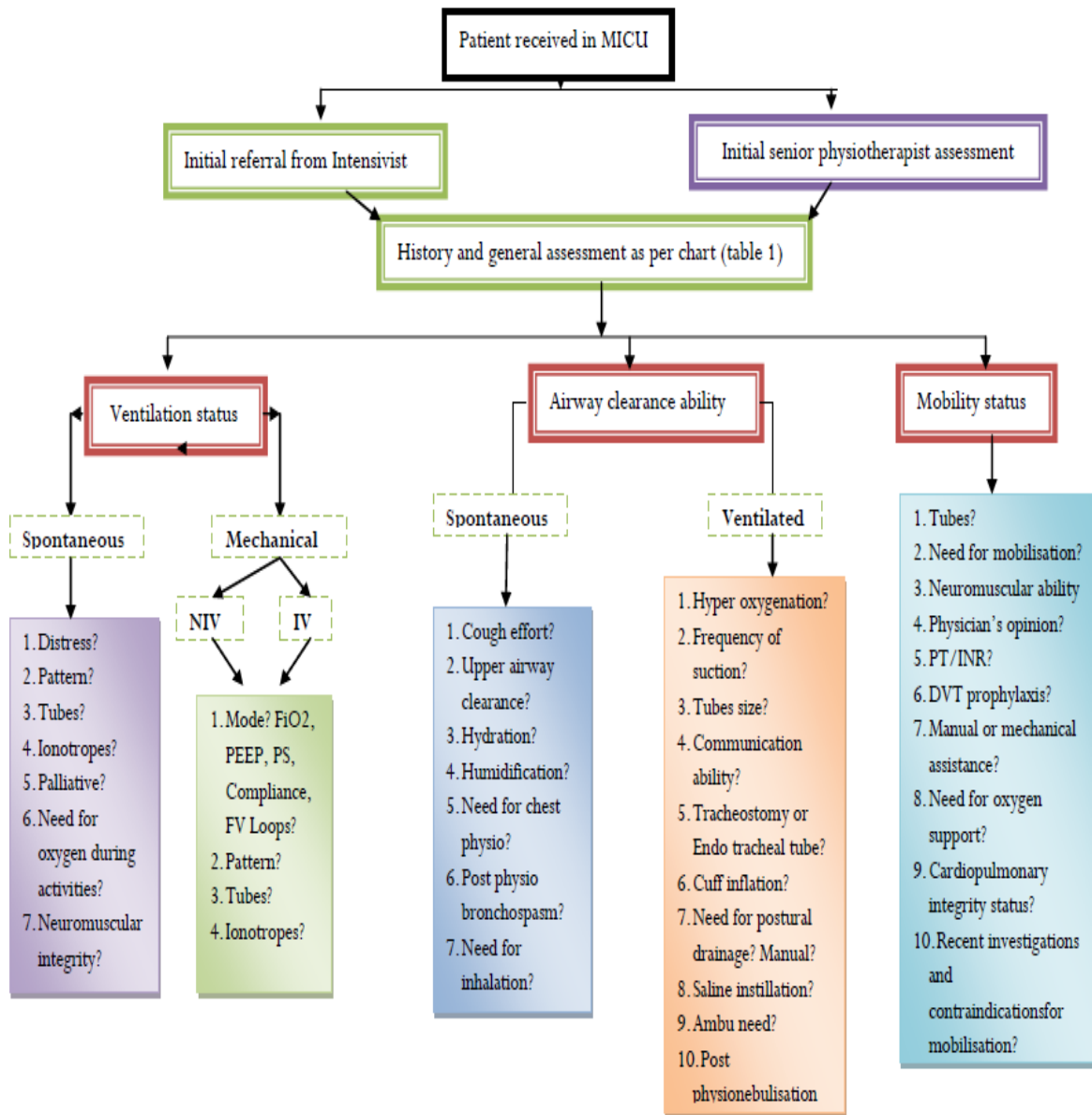


Figure.2: Therapeutic assessment and outcome measures.

TREATMENT MEASURES IN ICU

Early mobilization and physical activity

This is the prime and foremost goal of the ICU therapeutic team. Evidence claims the early mobilization shall decrease mortality, economic cost, ^[5,6] incidence of delirium, length of stay in ICU, reduction in impact of primary illness and increase sense of wellbeing, functional independence, early return to social activities and quality of life. ^[7-11] Mobilization plan is explained in **Figure.3**.

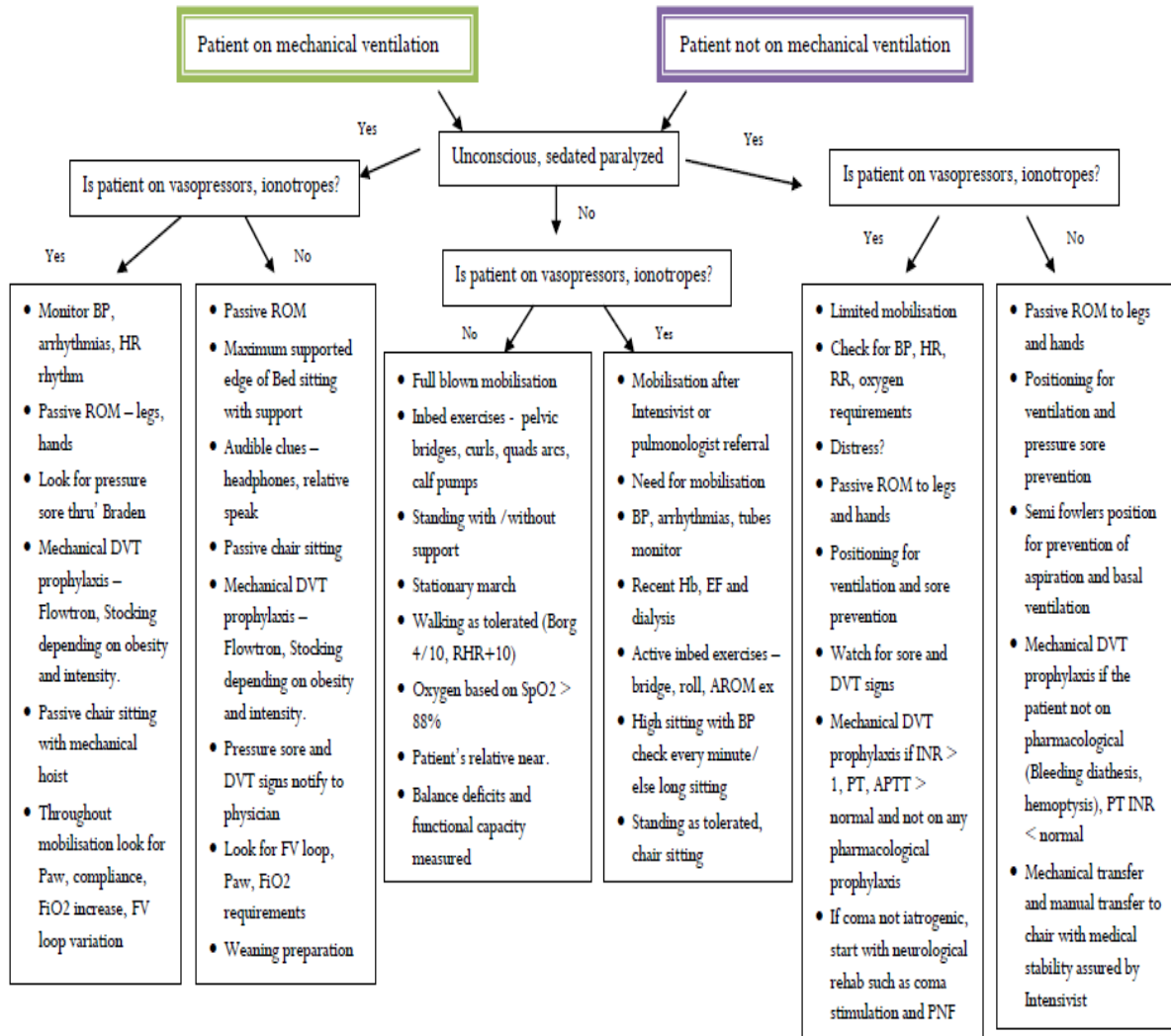


Figure.3: Mobilization plan tree.

The 2nd hourly position: This is in liaison with nursing staff, the 2nd Hourly position chart shall be maintain to combat the risk of pressure sore and DVT incidences. [12] The contraindications to frequent turning (such as ARDS, severe trauma, vasopressors support, and immediate resuscitation) shall be opined from the concerned unit physician or senior Intensivist. The 2nd hourly position which includes long sitting within bed, high sitting, chair sitting and standing with or without support.

Long sitting within bed: This is done for almost all the patient in ICU except comatose (semi-reclined), high nor-adrenalin support. This is done to avoid aspiration, facilitating ventilatory pattern, to decrease muscle works for respiration, to improve alertness or sensorium, to maintain

and promote good cardio respiratory parameters.

High sitting (dangling): This is done in conscious patients whose ventilation impaired due to recent pulmonary, cardiac or neuromuscular (stroke) pathology. Evidence claim that high sitting promotes increased basal ventilation, improved trunk support and reduces cardiac overload, and also to improve equilibrium and balance, to promote sitting ADL activities.

Chair sitting: Shall be practiced in stroke, surgical, stabilized sub-acute cardio pulmonary patients to gain confidence in patients who is recovering from ICU, improves patients communication ability, promotes further ADL activities, and to initiate further mobilization programmed like standing, walking with appropriate parameters.

Standing with or without support: This is done in liaison with nursing staff. Care shall be taken for dislodgement of tubes, cardiac compromise, imbalance and neuromuscular compromise. High standing shall not be executed in recent CPR. If the patients not supported adequately can use rollator walker, high standing frame or table, with help of other healthcare workers can initiate further mobilization like walking around the cot or room. Walking: This may be done in the presence of mobile ventilator, oxygen support and walker assistance. The walking intensity shall be decide on higher functions (GCS > 8/15, well oriented obeying commands), muscle power (MRC > V4/5), patient comfort, vital stability [SpO₂> 90%, Heart rate rest < 100/min, walk heart rate rise < 20 BPM, not on any ionotropes, MABP > 70 mmHg, no drop in post walk BP < 10 mmHg, FiO₂ < 0.4, pyretic (T > 99°F)], berg balance score (> 3) and Borg's exertion (<5/10).^[10]

Supplemental oxygen assistance: This is based on exertional desaturation. Non desaturations if breathlessness with no obvious saturation decrease also shall be on supplemental oxygen if the clients are feeling comfortable with minimal level of FiO₂. Nasal cannula or facemask with venture shall be decided on the flow basis or the minimal oxygen requirement as advised by the pulmonary care physician. During inbed exercises or any transfers, a flow of extra 2 L/ min than the baseline if the patient shall complaints of fatigue, breathlessness, desaturation or discomfort during exertion.

Ventilatory independence

Ventilatory independence can be achieved through airway clearance, breathing exercises, and mechanical ventilation liberation. Patients who have ventilated through intubation or non invasive ventilation needs to improve with airway clearance techniques and correct breathing control exercises, if the patients

tolerated assess for weaning process or train the patients through ventilator modes and making the patient to breath easily with ventilator through proper positioning, breathing retraining and adequate T-piece spontaneous breath trail before weaning. Weaning failure patient is treated adequately with ICU team members according to the results weaning process should be carried. Functional independency achieved with good counseling, communication among with family members, motivating the patients to do ADLs in the bed side with or without assistance.

a. Airway clearance

It is the prime motto of the MICU respiratory physical therapy team. The pulmonary disabled, drowning, sepsis, poisoning, traumatic and neurologically impaired, expiratory muscle weakness patients shall be the target patients for the airway clearance. The bulbar palsied, bronchiectasis, comatose, ventilator initiated individuals shall require airway clearance at a higher frequency.^[1] Protocol for airway clearance strategies in MICU is explained in **Figure.4**.

Indications:

- Excessive secretion production: bronchiectasis, foreign tubes – ET, tracheostomy, RT, airway tubes, lung abscess, comatose, epilepsy, endocrine dysfunction, and upper airway trauma.
- Failure in secretion clearance: Comatose, sedated, paralyzed, stroke, GBS, poisoning, higher level spinal cord injury, ET and tracheostomy tubes, post abdominal surgery, and thoracic surgery.
- Secretions thickening: Increased chloride electrolyte, Noninvasive ventilation, no humidified connected, excessive breathlessness, and neurologically impaired

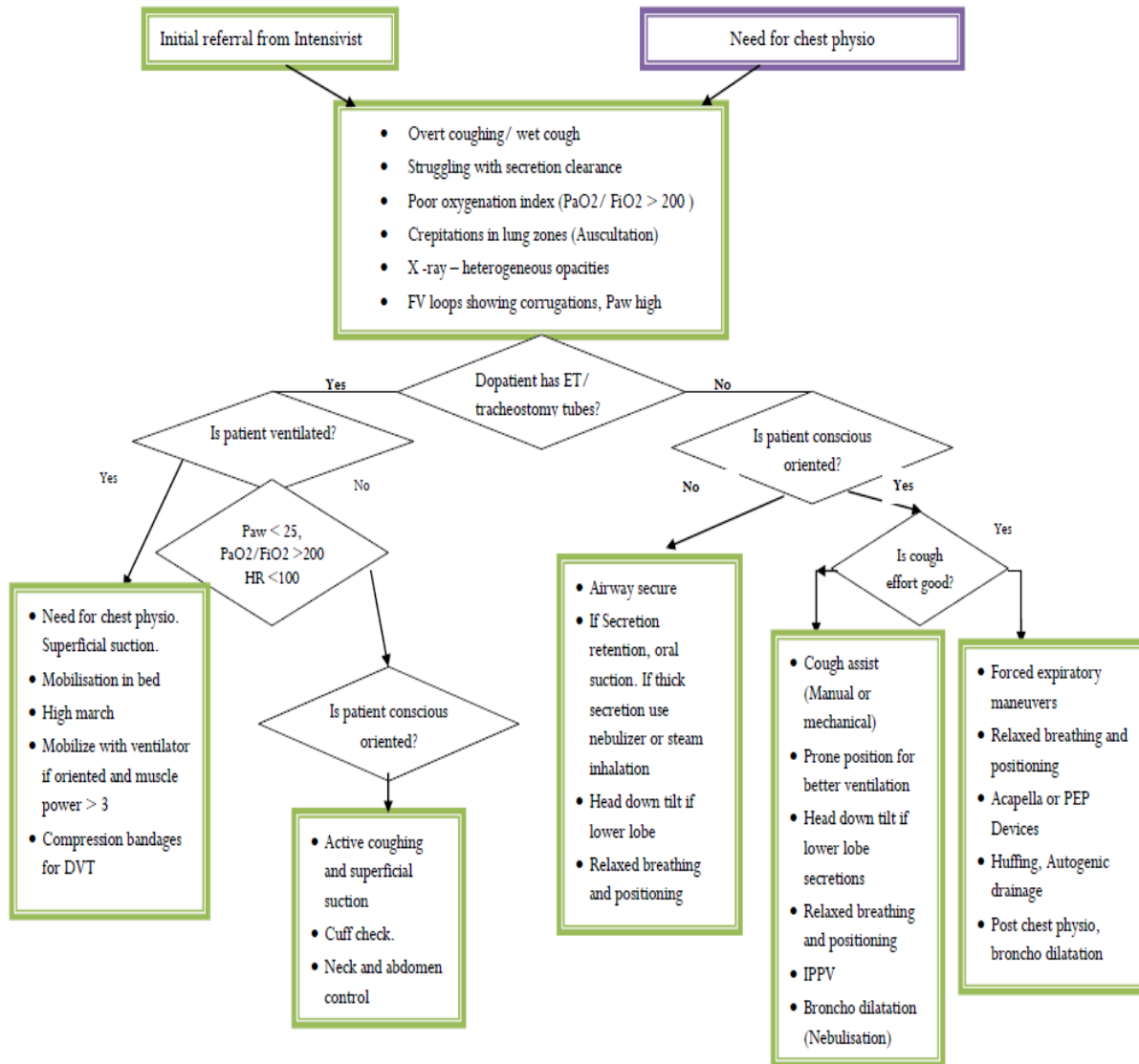


Figure.4: Airway clearance assessment.

Contraindications:

- Uncontrolled acute hemoptysis (If physician opinion regarding stability and patient breathlessness, cough, fever and radiological collapse probably due to underlying clots in alveoli, then gentle airway clearance to be carried out),
- Rib fracture, nasal bone fracture, immediate post operative thoracic surgery and head injury with risk of increasing intracranial pressure - no percussion, shaking or head down,
- Recent liver failure, severe GERD, aspiration – no head down position unless physician presence, High PEEP, Pressure support, medications like sedatives and paralytics,

antiarrhythmics, vasopressors and high FiO2 - minimal handling of patients and minimize open suction frequency.

b. Breathing exercises

It shall be administered in the view of increasing ventilation, pulmonary expansion thereby increasing tissue ventilation perfusion perfect, reducing tissue hypoventilation and hypoxic injury. Breathing exercises are proved to have positive effects on length of ICU stay, increase pulmonary efficiency and breathing reserve, early ward activities in spite of primary pathology for admission to intensive care. [13]

Manual techniques:

- Diaphragmatic breathing exercises: This type of breathing relaxes the diaphragm and abdominal muscles there by increases the vertical vital capacity of lung. This type of breathing said to be effective during anxious hospital stay, ICD or rhyles tube, thoracic abdominal surgery and COPD. It should be emphasized that overtraining may cause the risk of hyperventilation and barotraumas.
- Purse lip breathing exercises: These types of exercises shall be effective in COPD and small airway diseases where backpressure said to regulate the collapsibility of the airways. Usually in acute hospitalization patient adapts to prevent the bronchospasm himself. If the patient has not adapted, the technique shall be taught as a protocol.
- Glossopharyngeal breathing: This type of exercises shall be employed in higher spinal cord injuries where only facial and neck muscles are working with no activity from intercostals and diaphragm. Lumps of air shall be engulfed and ingested by the tongue into the trachea. Ingestion into esophagus and air swallowing is common.
- Chest expansion exercises: This shall be executed in case of COPD, atelectasis, neuromuscular patients (Stroke, GBS, poisoning) and post ventilated critical illness polyneuropathy patients who may be at the risk of shortening of chest muscles and poor lung expansion thereby increasing length tension relationship and hence ventilation perfusion matching.

Mechanical techniques:

This shall be executed in forms of incentive spirometer, inspiratory muscle training devices, ^[13] EzPAP (positive airway pressure device) and Acapella, lung flute for

lung expansion and airway clearance by providing biofeedback or visual incentive for the lung expansion and airway clearance through intraoral oscillations. ^[14,15] Some manual techniques may be combined with nebulizer and humidification as an adjunct to airway clearance and lung expansion.

Mechanical Ventilation liberation

Weaning from mechanical ventilation and early return to the step down wards and home shall be the prime component of respiratory physical therapy in ICU. Researches states the complications such as critical illness, delirium, increasing hospital and ICU stay, ventilator associated pneumonias, increased mortality, increasing healthcare cost, increased drug dependence, increased chronicity of the prime pathology shall be combated by early liberation from ventilator and returning stability of the patient to at most stability.

Weaning assessment and therapy:

The weaning assessment is described in **Figure.5**. The therapist shall coordinate with the Intensivist or the concerned unit physician in planning for early weaning assessment and liberation from mechanical ventilation as early as possible. The weaning from mechanical ventilation (change in mode or trigger) shall be exercised in the presence or in the knowledge of Intensivist or pulmonologist concerned. The senior therapist shall review the everyday investigation and progress cards, real time and PACS, HIS investigation e-copies for following up the prime pathology reduction, changes in the arterial blood gases (metabolic stability), cardiopulmonary stability, fluid and energy balance as a part of activity monitor in ICU. ^[16-18]

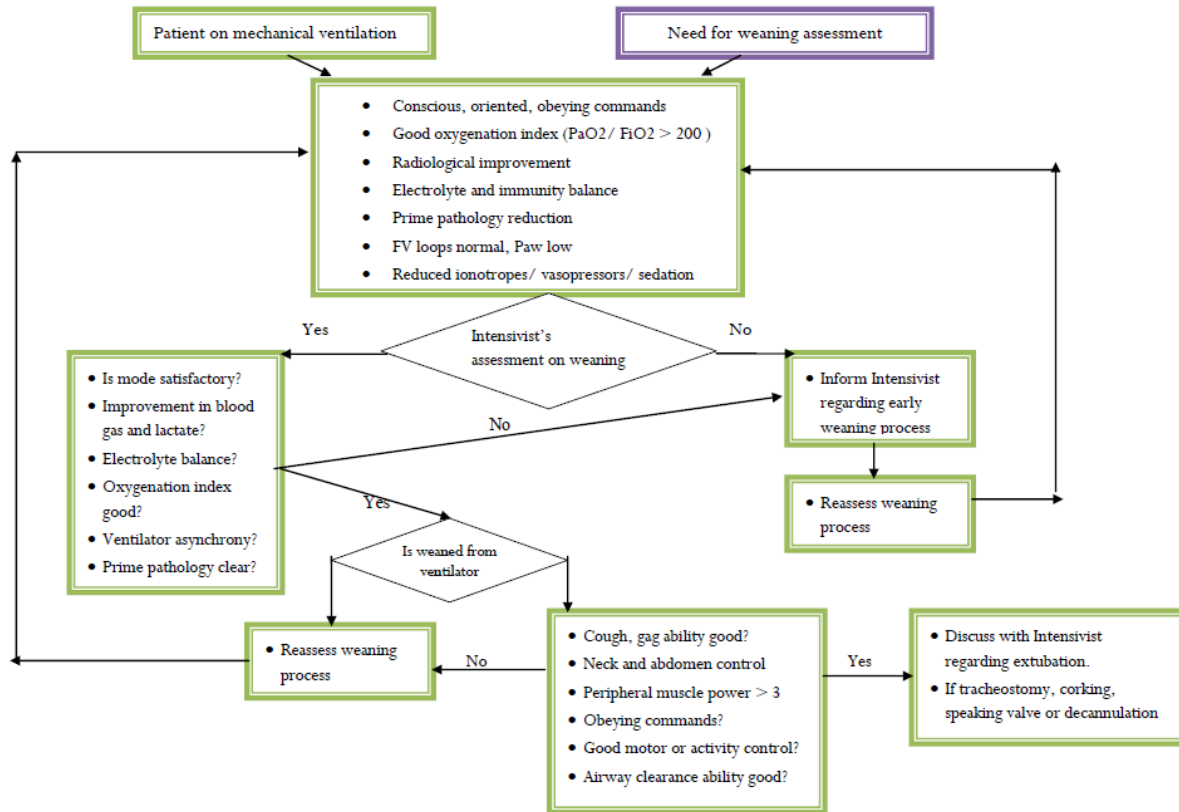


Figure.5: Weaning assessment.

Caution: Never change mode / trigger setting by therapist himself/ herself. Increasing oxygenation (FiO₂) other than suctioning (During mobilization) shall be discussed with Intensivist or pulmonologist. If PEEP > 8 cmH₂O, never disconnect for suctioning or mobilization without consent of the Intensivist. Checking for mode, FIO₂, PEEP, Paw, dynamic compliance and resistance, flow volume loops, 24 hrs trends in FiO₂ requirement, Volume, pressure change shall be exercised strictly for the 24 hrs physiotherapy plan in MICU.

During mobilization or suctioning, accompanying staff nurse or physician is a must. Follow universal precautions (Glove, goggles, apron, and masks) for contagious person or immunocompromised patients. Mechanical adjuncts such as threshold inspiratory muscle trainer and other resistance training modalities shall be added for early respiratory strength training without Valsalva maneuver. Care shall be exercised in case of persons with subdural hemorrhage, bleeding diathesis, COPD, recent trauma to oral cavity, blunt abdomen,

portal hypertension and ascites and with pleural disorders where negative pressure may be contraindicated.

Functional independence:

During the mechanical ventilation, the patient restrains to the bed clinically due to the prime pathology, tubes (ventilator, RT aspiration, Foley's, Monitor, ICD, CVP, infusion), sedation, paralytic agents, neuromuscular inability, breathlessness and restraints. Respiratory physical therapist shall administer his/ her therapeutic skills to attain at most functional independence such as passive (unconscious sedated) and active mobilization (conscious, oriented) ranging from in bed, standing to walking with mobile ventilator.

Pre mobilization check list such as oxygenation index, mechanical ventilation status such as high PEEP, high FiO₂ requirements, high Paw, volume or NAVA modes, acute respiratory distress in spite of adequate pharmacological management monitors such as SpO₂, cardiac rate and rhythm, no arrhythmias, no sedatives and ionotropes, physician's opine regarding

mobilization, prime pathology hindering mobilization, early use of walking aids, recent surgeries such as valve, knee replacements, spinal pathologies, higher mental functions and motor power, balance deficits such as retinopathies, Vertigo, cochlear implants, ear surgeries, neuromuscular dysfunctions such as stroke, GBS, Parkinson's shall be considered.

The mobilization aids such as mechanical hoists, mobilization team not limited to staff nurse, duty therapist and in very acute cases, physician's presence and walking/ supporting aids such as walker, cane shall be entertained. In cases of limb weakness / defects such as pressure sore, diabetic ulcers, amputees, mechanical adjuncts such as non contact boot, orthotic corrections such as foot drop splint, calipers shall be administered. In case of spinal cord injuries or Spinal pathologies such as TB spine and carcinomatous metastasis leading to compression fractures shall be mobilized with appropriate spinal brace either Milwaukee or Jowett's.

The mobilization criteria such as inclusion or termination shall be strictly followed. If any incident of sudden fall, knee bucking, collapse, minor problem such as giddiness, chest pain, and breathlessness shall be informed promptly to the intensive care physician and prompt treatment for the same. [19] Further major incidents shall be documented in incident register. The outcome measures such as progress in activity during physiotherapy session, handgrip strength, in bed total activity, out of bed activities such as chair sitting and walking distance, real-time monitor such as heart rate, saturation and BP pre and post mobilization status shall be notified and follow-up until patient gets discharged from intensive care unit.

CONCLUSION

Initiation of this protocol based assessment and implementation of physiotherapy inside the ICU is safe and beneficial while practiced with good team members. Our views may differ with other

national practices but it is easier to practice with simplest ideas and planning which we currently practicing in our domain. It is useful for the new comer in ICU team for making effective treatment. Involving a multidisciplinary team, with a recognized leader, can be effective in changing ICU culture and practice to effectively deliver early mobilization and rehabilitation.

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