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AN OBSERVATIONAL STUDY ON FEASIBILITY OF GRADED EARLY MOBILISATION IN MECHANICALLY VENTILATED PATIENTS

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ABSTRACT

Background: Early mobilisation is found to have a tremendous effect on patients with Mechanical Ventilator. Despite known benefits, it is not commonly practised in India. ICU rehabilitation is not adequate as lacunae in knowledge persist. Lack of manpower, equipment and fear of adverse effects has been the main barriers for not initiating Early Mobilisation in regular ICU practices. **Aim:** To find out the feasibility and to evaluate the physiological variations during graded early mobilisation in mechanically ventilated patients from the day of intubation to the day of ICU discharge. To find out barriers during early mobilisation in ICU. **Study setting:** This Observational study recruited subjects from Multi-disciplinary intensive care unit of a tertiary care hospital. **Methods:** 26 subjects who met inclusion criteria of mean age 62.3yrs and mean BMI 24.12kg/m2 from both genders received graded early mobilisation from the day of intubation to the day of ICU discharge. Pre and Post vitals were noted for each session and the barriers that limited grade of mobilisation was documented. Standard safety ICU mobilisation guidelines were followed. **Result**: Out of 26 patients, at the time of discharge 6 subjects (23%) received passive mobilisation, 10 subjects (38.5%) received in-bed mobilisation and 10 subjects (38.5%) received out-bed mobilisation. On pre-post-analysis of physiological variation in subjects who received stage 5 mobilisation statistical significant variation was noted and it was within safety limits. We also noted that patients with respiratory conditions showed good progression in mobilisation. No adverse event occurred during the study period.

KEYWORDS: Intensive care unit, mechanical ventilator, mobilisation, intubation.

BACKGROUND

For decades, bed rest and medications were the only treatment given in mechanically ventilated patients and those patients were highly sedated for long terms [1]. Studies have shown that these patients have a poor functional outcome at the time of discharge from hospital, are very limited energy levels while performing day to day activities lasting till years, find difficulty in coping up with work even after one year of discharge.[2][3] Overall, a tremendous decrease in their quality of life is noticed.

Physiotherapy practices in ICU help patients to regain their functional status prevents further complications, helps in maintaining joint integrity, joint range of motion, muscle texture.[4] It has been proven in a few studies that even high-intensity exercises cannot prevent the patient from weakness and decreased functional outcome.[5] Hence, mobilisation is the only paradigm that's arising recently with proven benefits.

Mobilisation can be divided into two parts 1) active mobilisation and 2) passive mobilisation. Active mobilisation is where the patient uses his/ her strength and initiates the movement of their own. It can be further divided into two parts a) In-bed mobilisation and b) Out-bed mobilization.[6][7] Passive mobilisation is where the patient cannot perform any activity or initiate any movement and therefore therapist passively performs all exercises on the patient.

It has been observed worldwide that mobilising in an early stage can bring out the better functional outcome from patients on the day of discharge from ICU, can prevent from developing further complications, improves ventilation, improves blood parameters, and brings confidence inpatient and caretakers.[8][9] Even though mobilizing mechanically ventilated (MV) patients in early-stage has shown tremendous effect and clinical improvement in patients, it's not practised regularly in India. Fear of any adverse events for eg; fall on knees, self-extubation, desaturation etc. can withdraw the idea of mobilising a MV patient. Lack of awareness among

ICU staff and lack of mobilising equipment are the main barriers that are observed in ICU.[10][11]

It has been found that mobilizing mechanically ventilated patients in early-stage is safe and feasible as per worldwide study but is not commonly practised here in India as it can be difficult as per staff timing, highly sedated patients, lack of team approach and mobilizing equipment.[12][13][14] However, it can overcome by having staff discussion, prioritizing team approach and building up treatment protocols concerning published data and establishing a proper ICU rehabilitation program.[15] Identifying barriers that encounter early mobilisation is a major step towards the formation of new ICU protocols. Training staffs, spreading awareness on benefits of early mobilisation are key points towards the establishment.

Considering the above-stated point, it is necessary to modify physiotherapy practices in ICU and design a new ICU treatment protocol for the physiotherapist. For this, it is necessary to identify the barriers that limit mobilizing MV patients and find out the feasibility in our setup. It is essential to have a multidisciplinary team approach for the interaction of different elements to decide on the improvement of functional mobility of critically ill patients. The team can ensure safety on interventions and implementation of new ICU protocols.

METHODOLOGY

Study design

This is an observational study with sample size 30 which was conducted in Sri Ramachandra Medical Centre and Sri Ramachandra Medical College multi-disciplinary intensive care unit within the period of January'19 to March'19.

Subject recruitment

After obtaining the study approval by The Institutional Ethics Committee of Sri Ramachandra Medical College and Research Institute (REF: CSP/18/SEP/73/253), the subject has been recruited from both the multi-disciplinary intensive care unit in Sri Ramachandra Medical Centre and Sri Ramachandra Hospital. To meet the criteria, both male & female patient was included within the age group of 30 – 80 years who were on Mechanical Ventilator. Patients with any neurological condition, major lower limb fractures, raised Intracranial Pressure, a survivor of post-cardiac arrest and age beyond 80yrs were excluded.

Procedure

After screening for the eligibility, informed consent to participate was obtained from the subject or subject's caretaker along with a witness. Patient's physiotherapeutic assessment was conducted which included the patient's conscious level, ventilator parameters, vitals, functional status and musculoskeletal assessment. Along with conventional treatment i.e chest and limb physiotherapy, graded early mobilisation was initiated to subject starting from day of intubation to the day of ICU discharge. Required parameters were noted after each session. No adverse events or decline in health status was observed during the period of study. Intensivists were monitoring for any such events. Any barriers or strategies, if present, were documented.

Statistical analysis

In this study, data were collected from 26 Mechanically Ventilated patients who were diagnosed with respiratory conditions, renal conditions, post-surgical conditions and others. The collected data were tabulated and analyzed with SPSS version 16, the variables such as Age, Gender, mode of a mechanical ventilator, length of stay, the grade of mobilisation, Co-morbidities (Hypertension, Diabetes, Coronary artery disease), systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate and oxygen saturation were calculated and their mean and standard deviation were computed.

The association between pre-vitals and post-vitals was done by't' test.

Figure 1: Active exercises in supine lying position.

Figure 2: In-Bed Mobilisation with endotracheal tube (sitting).

Figure 3: In-Bed mobilization in NIV-PC mode (sitting).

Figure 4: Out-Bed Mobilisation in NIV- PC mode (standing).

Table 1: demographical data.

DATA	VALUES (N = 26)
GENDER	46.2% female (n = 12) 53.8% male (n = 14)
AGE	62. 30yrs
BMI	24.12 kg/m2
TOTAL NO. OF ICU DAYS	3 DAYS
COMORBIDITIES	84.61% (n = 22)
SMOKING	46.15% (n = 12)

RESULTS

Data collected from 26 Mechanically Ventilated patients were statistically analyzed and result tabulated.

Table 2: physiological variations in pre and post vitals- day 1.

	Mean	Standard Deviation	T- value	Significance
PRE- SBP & POST-SBP	6.579	7.366	3.893	.001
PRE-DBP & POST- DBP	4.474	6.794	2.870	.010
PRE- HR & POST- HR	7.579	11.027	2.996	.008
PRE- RR & POST- RR	1.833	2.995	2.597	.019
PRE- SPO2 & POST- SPO2	.278	1.809	.652	.523

Comparison between pre and post vitals on first day showing t-value and significance. SBP, DBP, HR and RR were found to be significant but SPO2 couldn't show any statistical significance.

Table 3: Physiological Variations in Pre and Post Vitals- Day 3.

	Mean	Standard deviation	T- value	Significance
PRE- SBP & POST- SBP	5.632	5.540	4.431	.000
PRE- DBP & POST- DBP	5.526	5.221	4.613	.000
PRE- HR & POST- HR	9.545	8.342	5.367	.000
PRE- RR & POST- RR	4.68182	3.59081	6.116	.000
PRE- SPO2 & POST- SPO2	.500	1.655	1.417	.171

Comparison between pre and post vitals on third day showing t-value and significance. SBP, DBP, HR and RR were found to be significant but SPO2 couldn't show any statistical significance.

Table 4: crosstabulation of mobilisation from day 1 to day 3.

	Day1	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
GRADE 0	6	2	0	2	2	0	0
GRADE 1	5	1	4	0	0	0	0
GRADE 2	9	0	0	1	6	1	1
GRADE 3	6	1	0	0	2	0	3

This table shows the progression of grade of exercise from day 1 to day 3. 6 subjects received grade 0 exercise from which 2 received grade 0 exercise, 4 subject received grade 1 exercises respectively on day 3 and so on.

DISCUSSION

The benefits of mobilisation in ICU are less understood and least studied in India.[16] This study was taken up to find out the feasibility of mobilisation in an Indian ICU setup.

We were interested in finding out the ICU practices followed elsewhere and to find out the awareness among physiotherapists about ICU mobilisation a survey has been conducted before the start of the study.

We did mail to 100 practising physiotherapists and received a reply from 12 physiotherapists. 91.7% of those respondents worked in multi-disciplinary ICU set up with 33.3 % having experience of more than 15 years and 66.7% having experience below 5 years. According to the survey it was found that active exercises, passive exercises, chest percussion and vibration, different types of breathing exercises and positioning of the patients were the common treatment provided to mechanically ventilated patients.

On analysis, it was found that 66.7% believed in early mobilisation (EM) in mechanically ventilated patients and 26.2% were not sure of it, 7.1% disagreed to the idea of EM considering the adverse events. In therapists who

mobilise the MV patients, 33.4% performed regular EM, and 33.3% performed but not regularly.

Analysing on barriers for mobilisation, awaiting physician approval, central lines and tubes, lack of motivation, invasive monitoring and inadequate staff were the commonly observed barriers.

Recent evidence suggests that patients with prolonged ICU stay and survivor of ICU stay have longstanding muscle weakness. Early mobilisation especially for patients on mechanical ventilator sitting out of bed, standing and walking help in reducing the muscle weakness and improves patient's outcomes.[17][18][19]

26 patients on the mechanical ventilator were taken for this study diagnosed with respiratory conditions (18), renal conditions (4), post-op surgical conditions (2) and others (2). Patients were admitted in ICU with reasons like breathlessness, Low GCS level, low sensorium etc (breathlessness was the major indication). Maximum patients had co-morbidities like diabetes mellitus, systemic hypertension, and coronary artery disease.

Patients of the age group from 30yrs to 80yrs with a mean age of 62.3yrs and mean BMI 24kg/m2 were recruited for this study. It was found that geriatric populations were more prone to mechanical ventilator support. In this study, 38.46% of subjects belonged to age group 70yrs to 80yrs; males count more than female. Pressure mode more commonly indicated than volume mode. In this study, 20 subjects were indicated for pressure mode and 6 were indicated for volume control.

In the present study, the criteria for mobilisation in ICU have been followed according to guidelines by Kathy Stiller and Phillips[20] and Preme C.[1]

The mean ICU stay of 26 patients is 3 days. On the due course of ICU stay, two patients underwent tracheostomy and got shifted to the ward. Four patients expired due to cardiac arrest out of these four patients: one received passive mobilisation, two patients did not receive any treatment and one received only for one day. Retrospective analysis of those two patients showed that no prominent ECG changes or changes in vitals were noted after passive mobilisation.

Among 26 patients on the day of intubation, 5 subjects received grade 1 exercises, 9 subjects received grade 2 exercises and 6 subjects received grade 3 exercises, 6 subjects did not receive any exercises (reason -consultant disagreed for 3 patients,2 patients deteriorated after intubation, 1 patient started with dialysis). The subjects who received grade 3 exercises on the day of intubation were respiratory conditions and Oxygenation Index showed improvement in the status as mobilisation progressed and which was more feasible in this group. Out of 6 subjects, 4 progressed to stage 5 and two remained in stage 3 All the patients have been assessed pre and post mobilisation and reassurance of vitals have been done after half an hour of mobilisation.

In this study, early mobilisation was implemented on 76.92% of subjects on the day of intubation and towards the discharge 38.46% received out-bed mobilisation, 38.46% received in-bed mobilisation and 23.07% received passive mobilisation. Admission to ICU results in a significant decrease in peripheral muscle strength and poor quality of life among ICU survivors. Within 7 days, a reduction in peripheral muscle strength by 11.3% has been observed with greater reductions in the deltoid (13% reduction) and least reduction in the ankle, plantar, and dorsiflexor muscle strength (10%).[1][21]

The baseline parameters increased within the safe limit and to a minimal level after mobilisation as per standard ICU guidelines. The variation noticed suggest that intensity of exercises could be increased by keeping those parameters in a safe limit. The criteria for mobilisation are heart rate less than 110/ min at rest, mean arterial blood pressure between 60 and 110 mmHg, the fraction of inspired oxygen less than 0.6, and oxygen saturation greater than 88% on activity.[1]

Physical therapy in the ICU appears to confer significant benefit in improving quality of life, physical function, peripheral and respiratory muscle strength, increasing ventilator-free days, and decreasing hospital and ICU stay. However, further controlled trials of better quality and larger sample sizes are required to verify the strength of these tentative associations. In a study done in Maharashtra to establish current physiotherapy practices, it was observed that the physiotherapists working in ICU vary in qualification, experience, clinical knowledge, and skills.[22]

Early mobilisation, particularly walking, that begins in the ICU in patients who are intubated and ventilated is advocated as a treatment intervention to attenuate muscle weakness and improve patient outcomes. A solution may be to develop stepwise protocols that prescribe mobilisation activity based on the cognitive level and physical capacity of the patient. Protocols such as these have been safely and effectively introduced into clinical practice.

Accumulating evidence suggests that the management of sedation can have an important effect on the outcomes of patients who are treated in ICUs.[4] Earlier studies have shown that patients with a low dose of sedation were ventilated for fewer amounts of days and were less prone to get ICU acquired weakness. Nevertheless, studies show that the reduction of sedation levels decreased ICU length of stay and ICU-related complications, but failed to improve long term outcomes.[8]

Barriers that were commonly found were physiological, administrative and culture. Physiological barriers were a high dose of sedation, patient unconscious state of mind,

unstable hemodynamic conditions. The patients who were drowsy for a long term were limited with the intensity of exercises, unconscious patients received only passive mobilisation and patients, not in stable conditions were allowed to rest.

Administrative barriers that were noticed are the timing of staff, physician's round, lack of equipment and intersection of therapies timing. As it is known patient undergo various therapies in ICU for betterment the allocated staff is limited with the timing with the patient. It can be avoided by having a proper time sequence for staff to attend the patient and also to avoid intersecting with the timing of other staff members. The Patient diagnosed with CKD were on dialysis and required constant monitoring throughout the day and also weaken the patient at the end of the procedure which limited the intensity of the exercises that planned be give. However, dialysis is an important aspect of management which should take place at the proper time.

Cultural barriers are common in India as the patient is not traditionally mobilised due to lack of education and unawareness about the benefits of early mobilisation. Lacunae in knowledge have been the devastating factor why India has not accepted the concept of Early Mobilisation so far. Other factors which limited patients for mobilisation were patients own condition and willing power. Lack of motivation for exercises and mindset for attaining only rest has limited in providing exercises. Patient's pain and tiredness were additional barriers that were noticed.

Barriers can be overcome by having a discussion with the team responsible for patients and establishing a new ICU rehab Protocol to implement early Mobilisation to patients who are in need. Counselling patients and providing them with awareness regarding exercise can motivate them to co-operate to perform exercises well.

In this study, it was found that 6 patients could not receive any sort of exercises due to the above-mentioned barriers. 20 patients have received active mobilisation on the day of intubation and therefore, it can be concluded that early mobilisation is feasible in mechanically ventilated patients. Out-bed mobilisation could be initiated to 5 patients on the 2nd day of intubation to the patient who participated in active mobilisation on the first day itself.

In this study, it was also found that patients diagnosed with respiratory conditions were more likely to achieve graded early mobilisation as compared to other conditions i.e. renal conditions, surgical conditions and others.

CONCLUSION

This study has shown that graded early mobilisation in mechanically ventilated patients is safe and feasible and can be practised in our set up. Proper training and awareness must be spread to ICU staffs for implementing early mobilisation in ICU rehabilitation protocol. Education must be provided about the benefits of early mobilisation. Patients must be motivated enough to perform exercises.

CONFLICT OF INTEREST

Nil.

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