



EFFECTIVENESS OF MULTISENSORY STIMULATION PROGRAMME ON COGNITIVE FUNCTION AND NEUROLOGICAL STATUS AMONG PATIENTS ON MECHANICAL VENTILATION

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ABSTRACT

The present study investigated the effectiveness of multisensory stimulation programme on cognitive function and neurological status among patients on mechanical ventilation at Govt. Medical College Hospital, Kottayam. A quantitative approach was used and quasi experimental post test only research design was selected. The study was theoretically supported by Sr. Callista Roy's Adaptation model. A total of 60 patients on mechanical ventilation, 30 each in control and experimental group were selected using purposive sampling technique. The data were collected using socio personal and clinical data sheet, Folstein's mini mental state examination scale and Glasgow coma scale. Multisensory stimulation programme was given only to the experimental group while the subjects in the control group received routine care. Post test was conducted after extubation, both in control and experimental group. The data was analysed using descriptive and inferential statistics. After the intervention, none of the subjects in the experimental group had severe cognitive impairment whereas 20% of the subjects in control group had severe cognitive impairment. In the neurological status 36.7% of the subjects in control group had confused speech in the verbal response score whereas all the subjects in the experimental group had oriented conversation. The results of the study revealed that multisensory stimulation programme had a statistically significant effect on cognitive function ($p < 0.05$, $U = 33$) and verbal response score of neurological status ($p < 0.05$, $U = 285$) among patients on mechanical ventilation. ie, multisensory stimulation programme is effective in improving both the cognitive function and neurological status among patients on mechanical ventilation.

KEYWORDS

cognitive function; neurologicalstatus; multisensory stimulation programme

INTRODUCTION

An intensive care unit is defined as a specially staffed and equipped, separate section of a hospital dedicated to the observation, care and treatment of heterogenous population of patients with life threatening illnesses, but all share the need for frequent assessment and a greater need for technological support than patients admitted to non- intensive care unit beds. The most common technological support is mechanical ventilation, required by 20%-40% of intensive care unit admissions¹.

Globally critical illness has been crudely estimated to result in several million deaths each year². Approximately 55000 patients are hospitalized in intensive care unit each day and over 5.7 million critically ill patients are admitted to intensive care unit, each year in United States³. Admission in the intensive care unit provides great physical and psychological tension to the patient. Mechanical ventilation, pain, powerlessness, experiences of social and physical disconnection, being away from family members and short duration of visiting time are considered as risk factors or causes of psychological tension for patients. The fear of being an intensive care unit patient, uncertainty about the future, isolation from family, financial pressure, impaired communication and exposure to an unfamiliar environment result in severe emotional imbalances in patients. In the intensive care unit environment, most patients experience stress due to anxiety about their prognosis; the unfamiliarity of the intensive care unit and its treatment; limited visiting hours and cognitive, emotional, and behavioural stress depending on the dispositions of medical team members. This can cause the patient to resort to inappropriate coping methods, high levels of anxiety, depression, and feelings of panic, chaos, and a need for constant vigilance⁴.

Mechanical ventilation is a risk factor for the development of adverse neurocognitive outcomes and one in eight patients on mechanical ventilation develop altered state of consciousness during intensive care unit stay. Acute onset mental disturbance including loss of awareness and cognitive impairment that changes over time occurs in 60-80% of critically ill patients who are receiving mechanical ventilation and in 20-50% of critically ill patients who are not receiving mechanical ventilation⁵.

Multisensory stimulation interventions have become increasingly popular in the treatment of neurocognitive disorders and holds the most promise of an individualized, easy-to-implement, cost-effective intervention with minimal supervision required. Multisensory stimulation could be an effective intervention for managing neuropsychiatric symptoms in older adults with major neurocognitive disorder, particularly for managing behavioural symptoms such as

agitation, the effectiveness in cognitive domains such as memory and attention to surroundings. Sensory stimulation has a positive impact on patients with decreased consciousness. Multisensory stimulation environments produce immediate positive effects on the behaviour and mood of people. Prolonged stimulation may exceed an individual's threshold, whereas prolonged lack of stimulation may result in sensory deprivation. There is growing support for the use of multisensory stimulation interventions to improve mood, behaviour and quality of life in people with neurocognitive dysfunction⁶.

Statement of the problem

Effectiveness of multi-sensory stimulation programme on cognitive function and neurological status among patients on mechanical ventilation in a selected tertiary care hospital, Kottayam.

OBJECTIVES

- To assess the cognitive function among patients on mechanical ventilation
- To determine the neurological status among patients on mechanical ventilation
- To evaluate the effectiveness of multi-sensory stimulation programme on cognitive function among patients on mechanical ventilation
- To evaluate the effectiveness of multi-sensory stimulation programme on neurological status among patients on mechanical ventilation

Hypotheses

H₁: There is a significant difference in cognitive function among patients on mechanical ventilation between control and experimental group

H₂: There is a significant difference in neurological status among patients on mechanical ventilation between control and experimental group

METHODOLOGY

Research approach: Quantitative approach was used for the study

Research design: In order to achieve the objectives of the study, quasi experimental post test only design was used.

Setting of the study:

The study was conducted at medical intensive care unit (MICU), medical critical care unit (MCCU) and intensive respiratory care units (IRCU) of Govt. medical college hospital Kottayam.

Population:

Patients on mechanical ventilation admitted in Govt. medical college hospital, Kottayam

Sample and Sample Size:

Sample includes 60 patients on mechanical ventilation in medical intensive care unit, intensive respiratory care unit and critical care units of Govt. medical college hospital, Kottayam.

Sampling technique:

A total of 60 subjects were selected by non-probability purposive sampling technique. First 30 subjects were included in the control group and second 30 subjects were included in the experimental group.

Sampling criteria**Inclusion criteria**

Patients on mechanical ventilation and who are:

- on invasive modes of mechanical ventilation which include synchronized intermittent mandatory ventilation (SIMV), pressure support (PS), or continuous positive airway pressure (CPAP).
- not on sedatives
- hemodynamically stable
- able to understand Malayalam and/or English
- within the age group of 21 to 60years

Exclusion criteria

Patients on mechanical ventilation and who are:

- having visual or hearing impairment
- on continuous mandatory ventilation (CMV) mode
- having stroke
- having head injury

Description of the tools

Tool 1: This tool has two sections

Section 1.1: Socio personal data sheet

It is a structured data sheet which was prepared by the investigator and consists of five items. The data of the patient was collected from the informant which includes age, gender, marital status, education and occupation.

Section 1.2: Clinical data sheet

Clinical data sheet consists of four items. It is obtained from the patient record and it consist of clinical diagnosis, number of days in ICU, number of days in mechanical ventilation and mode of ventilation.

Tool 2: Mini mental state examination (MMSE)

Folstein's MMSE is a standardized tool extensively used to measure cognitive impairment in clinical and research settings. It was administered to patients who had normal hemodynamics and oxygenation after extubation. The scale used for collecting data consist of orientation, immediate recall, attention and calculation, recall and language. The maximum mini mental state examination score is 30. A score of 24-30 indicates no impairment, 18-23 is mild cognitive impairment and 0-17 is severe cognitive impairment as per Tombaugh and McIntyre's scoring (1992) of Folstein's MMSE (1975)⁷.

Tool 3: Glasgow coma scale

The Glasgow coma scale is a neurological scale which aims to give a reliable and objective way of recording the state of persons neurological status. To calculate the patient's GCS, the scores from eye opening, verbal response, and motor response will be added together, this gives an overall score with a maximum of 15. Neurological impairment can be scored as mild (13-15), moderate (9-12) and severe (8 or less) according to the score obtained⁸.

Data collection process

The research study was started after getting approval from Scientific review committee, institutional ethical committee and formal permission the principal Govt. medical college Kottayam and Head of department of medicine, Govt. Medical College Hospital, Kottayam, and approval from KUHS. The duration of the study was six weeks from 01-03-2021 to 10-04-2021.

Sixty patients on mechanical ventilation were selected as per inclusion and exclusion criteria, control group 30 subjects from medical critical care unit and intensive respiratory care unit and experimental group 30

subjects from medical intensive care unit. Non-probability purposive sampling technique was used for selection of the subjects. The investigator introduced her to the subjects and established good rapport with them. Purpose of the study was explained to the participants and informant, informed consent was obtained from the informant. After three days of routine care, post test was conducted for control group. Multisensory stimulation programme was given to the experimental group, two times daily, each session lasts for twelve minutes for consecutive 3 days along with routine care. Post- test was conducted after extubation for both the experimental and control group and data was collected using Mini Mental State Examination and Glasgow coma scale.

Analysis of the data**Section 1****Section 1.1 Socio personal data**

- Among the 60 subjects, majority of the subjects (43.3%) in the control group and 26.7% of subjects in the experimental group belonged to the age group of 51-60 years.
- Majority of subjects (60%) in the control group and experimental group (73.3%) were males.
- Most of the subjects (83.3%) in the control group and experimental group (86.7%) were married.
- With regard to education, 36.7% subjects in the control and 50% of the subjects in the experimental group were studied up to secondary school.
- Among 60 subjects, 33.3% of the subjects in the control and 30% of subjects in the experimental group were manual labourers. Among 60 subjects, 33.3% in control group and 26.7 % in experimental group were unemployed.

Section 1.2 Clinical data

- Clinical diagnosis of majority of the subjects in the control group (70%) and in experimental group (53.3%) was pulmonary disorders.
- Duration of ICU stay for the majority of subjects (63.3%) in control group and experimental group (76.7%) was 4-6 days and few subjects in control group (20%) and experimental group (16.7%) had a period of more than 6 days of ICU stay.
- Analysis of the duration of mechanical ventilation, showed that most of the subjects in control group (83.3%) and experimental group (86.7%) were mechanically ventilated for 4-6days and a few subjects in control group (16%) and experimental group (13.3%) were on mechanical ventilation for 1-3days.
- Study revealed that majority of the subjects (46.7%) in the control group and 56.7% of subjects in the experimental group, mode of ventilation was continuous positive airway pressure. Among 60 subjects, 33.3% of the subjects in control and 20 % of the subjects in experimental group, mode of ventilation was pressure support.

Section 2. Cognitive function and neurological status of patients on mechanical ventilation**Section 2.1 Cognitive function of patients on mechanical ventilation**

Study revealed that 70% of the subjects in the control group had mild cognitive impairment and in the experimental group 96.7% of the subjects had no cognitive impairment. Among 60 subjects, 20% of the subjects in the control group had severe cognitive impairment whereas none of the subjects in the experimental group had severe cognitive impairment.

Section 2.2 Neurological status of patients on mechanical ventilation

Study revealed that in GCS score, 36.7% of the subjects in the control group had confused speech whereas all the subjects in experimental group had oriented conversation in the verbal response score. Both in the control group and experimental group, all the subjects had the maximum score in eye response and motor response.

Section 3. Effectiveness of multi-sensory stimulation programme on cognitive function and neurological status among patients on mechanical ventilation**Section 3.1 Effectiveness of multi-sensory stimulation programme on cognitive function among patients on mechanical ventilation**

Table 1 Mean rank, sum of ranks and U value of post test scores of cognitive function among patients on mechanical ventilation between control and experimental group (n=60)

Group	Cognitive function		U
	Mean rank	Sum of ranks	
Control (n = 30)	16.60	498.00	33.00*
Experimental (n = 30)	44.40	1322.00	

The data presented in table 1 shows that the mean rank of post test scores of cognitive function among patients on mechanical ventilation in control group was 16.60 and in the experimental group, it was 44.40. The obtained U value is significant at 0.05 level. Hence the null hypothesis is rejected and it can be inferred that there is a significant difference in the cognitive function of patients on mechanical ventilation between control and experimental group. Hence it can be interpreted that multisensory stimulation programme is effective in improving cognitive function of patients on mechanical ventilation.

Section 3.2 Effectiveness of multi-sensory stimulation programme on neurological status among patients on mechanical ventilation

The eye response and motor response scores of all the subjects, both in the control group and experimental group were equal and there was no significant difference in the post test scores of neurological status of patients on mechanical ventilation between control and experimental group in terms of eye response and motor response. But a significant difference was found out in the verbal response of experimental and control group.

Table 2 Mean rank, sum of rank and U value of post test scores of verbal response in the neurological status among patients on mechanical ventilation between control and experimental group (n=60)

Group	Verbal response score of neurological status		U
	Mean rank	Sum of ranks	
Control (30)	25.00	750.00	285*
Experimental (30)	36.00	1080.00	

The data presented in table 2 shows that the mean rank of post test scores of verbal response among patients on mechanical ventilation in control group was 25.00 and in the experimental group was 36.00. The obtained U value was 285 which is significant at 0.05 level and hence it can be interpreted that there is a significant difference in the verbal response scores of patients on mechanical ventilation between control and experimental group. Hence it can be inferred that multisensory stimulation programme is effective in improving verbal response of neurological status of patients on mechanical ventilation.

Nursing implications

Nursing service

Providing multisensory stimulation programme for patients on mechanical ventilation provide a challenge to both medical and nursing staff who may struggle to meet the patient's physiological and psychological needs. So, this study is promisingly worthy, with regard to the nursing service as the work precisely deals with the matter related to cognitive and neurological function of patients on mechanical ventilation.

The practice of multisensory stimulation programme in intensive care unit as an intervention helps the patient to adapt to the intensive care unit environment, to overcome psychological and physiological tension, to prevent neurocognitive dysfunctions and to achieve better outcome. The study findings help the nurses to use multisensory stimulation programme in critical care setting to assist the patient for early recovery and shorter intensive care unit stay.

Nursing education

Education plays a major role in rendering quality nursing care. Nurse educators should use the knowledge to identify the need for changes in nursing education curriculum based on the findings of the study. So, the nursing curriculum should incorporate new strategies like multisensory stimulation programme for conscious mechanically ventilated patients as a part of holistic nursing care, by meeting their physiological, psychological, social, spiritual and comfort needs.

Nurse educators can equip the student nurses to sharpen their skill in providing sensory stimulation for patients on mechanical ventilation to overcome sensory deprivation and to identify and solve their psycho emotional problems and prevent neurocognitive dysfunctions which can occur either due to sensory overload or deprivation and thus contribute to better outcome.

Nursing administration

An administrator plays a key role in an organization to formulate policies, protocols and procedures to execute the excellent nursing care based on these study findings. They can take initiative to develop different protocols and guidelines for multisensory stimulation programme techniques to prevent neurocognitive dysfunction like delirium, to reduce number of days in intensive care unit and to promote early recovery of patients especially among mechanically ventilated conscious patients in critical care units. The nurse administrators can arrange inservice education and training regarding management of patients on mechanical ventilation with special emphasis on the importance of giving sensory stimulations as non-pharmacological interventions which is as important as pharmacological interventions.

Nursing research

Nursing research is needed for evidence based practice. The present study focused on the effectiveness of multisensory stimulation programme on cognitive function and neurological status among patients on mechanical ventilation. The published research studies and trials on this topic in Indian setting being less, this study serve as a scientific basis for the budding nurse researchers. Nurses can take initiative to conduct more research studies on related aspects of patients on mechanical ventilation with large samples. This study results will motivate staff and student nurses to conduct research and to practice sensory stimulation for critically ill patients on mechanical ventilation as the patients may be either overloaded or deprived of sensory stimuli in critical care settings.

Limitations

- Duration of study was short, so long term effects of sensory stimulation on neurocognitive functions could not be evaluated
- Failure to control unwanted sensory stimuli in the environment
- Inconvenience to provide sensory stimulation by a close family member due to covid protocols
- Generalization of the results has been limited due to nonprobability purposive sampling technique
- Study was limited to conscious patients on synchronized intermittent mandatory ventilation, continuous positive airway pressure or pressure support modes of mechanical ventilation

Recommendations

In the light of the present study, the following suggestions were put forth

- The same study can be replicated with large sample size
- The same study can be repeated in pediatric population especially in premature babies and in mentally challenged children
- A comparative study can be conducted to assess the effectiveness of multisensory stimulation on neurocognitive function among patients on invasive and non-invasive ventilation.
- A qualitative study can be conducted to assess the lived experiences of patients who had experiences of mechanical ventilation
- A prospective study can be conducted to assess the neurocognitive functions of ICU patients at discharge, after 6 months and 1 year of interval after discharge
- Explorative studies can be conducted to identify factors contributing to stressful experiences in patients who had been mechanically ventilated
- Same study can be repeated to assess the effectiveness of multisensory stimulation programme on quality of nursing care and resource utilization among mechanically ventilated patients.

CONCLUSION

Study revealed that majority of the subjects in the experimental group (96.7%) had no cognitive impairment whereas in the control group, only 10% of the subjects had no cognitive impairment. None of the subjects had severe cognitive impairment in the experimental group whereas 20% of the subjects in the control group had severe cognitive impairment and 70% had mild cognitive impairment. Study also revealed that 36.7% of the subjects in the control group had confused speech whereas all the subjects in experimental group had oriented conversation in the verbal response score in the neurological status. Mann Whitney U was done to find out the effectiveness of multisensory stimulation programme on cognitive function. The obtained U value (U=33) was significant at 0.05 level. It is interpreted that there is statistically significant difference in the post test scores of cognitive function between control and experimental group. The eye response

and motor response scores of all the subjects, both in the control group and experimental group were equal and there was no significant difference in the post test scores of neurological status of patients on mechanical ventilation between control and experimental group in terms of eye response and motor response. There was significant difference in the verbal response scores of experimental and control groups. The effectiveness of multi-sensory stimulation programme on verbal response was found out using Mann Whitney U test. The obtained U value (285) which was significant at 0.05 level. Hence it is interpreted that there is statistically significant difference in the post test scores of verbal response of neurological status among patients on mechanical ventilation between control and experimental group. Hence it can be inferred that multisensory stimulation programme is effective in improving both the cognitive function and neurological status among patients on mechanical ventilation.

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