



**ORIGINAL RESEARCH PAPER**

**Physiotherapy**

**ROLE OF INTEGRATED PHYSICAL THERAPY INTERVENTION ON PULMONARY AND FUNCTIONAL OUTCOME IN A PATIENT WITH STATUS EPILEPTICUS**

**KEY WORDS:** Integrated physiotherapy, status epilepticus, and Oxygenation indices.

<b>A. Sankarganesh*</b>	Assistant Professor, SRM College of Physiotherapy, SRM University, Kattankulathur, Chennai. *Corresponding Author
<b>M. Karthikeyan</b>	Assistant Professor, SRM College of Physiotherapy, SRM University, Kattankulathur, Chennai.
<b>VPR. Sivakumar</b>	Dean, SRM College of Physiotherapy, SRM University, Kattankulathur, Chennai.

**ABSTRACT**

**Introduction:** Physiotherapy is widely used in the intensive care unit to minimize respiratory complications and altered the level of consciousness. In patients on mechanical ventilators with in status epilepticus leads to secondary pulmonary and functional deficits and the clinical outcome of physiotherapy are sparsely available.

**Objective:** To assess the changes in conscious level, pulmonary and functional outcome in patient with status epilepticus.

**Methodology:** Single-case study of a 37 Year Old male diagnosed with status epilepticus, admitted at neuro surgery ICU, SRM Medical College Hospital & Research Centre, Kattankulathur Chennai. The patient is a 37-year-old male with traumatic brain injury followed by a left decompressive craniotomy and cranioplasty diagnosed as status epilepticus. A2-month Physiotherapy Intervention program including chest physiotherapy, early mobilization and therapeutic exercises was given following which Glasgow Coma Scale (GCS), PaO<sub>2</sub>, FiO<sub>2</sub>, PEEP, Mode of Ventilator Support, Oxygenation index (PaO<sub>2</sub>/FiO<sub>2</sub>), (A –a) gradient, Chest X-ray, Functional Independence Measure (FIM) and Disability Rating Scale (DRS).

**Results:** The improvement in GCS, Oxygenation parameters PaO<sub>2</sub>, oxygenation index, (A-a) gradient, FiO<sub>2</sub>, PEEP, chest x-ray and functional parameters FIMS and DRS. There has been a modest improvement in consciousness level assessed with the Coma Recovery Scale.

**Conclusion:** An individualized integrated physiotherapy intervention improved the consciousness level, pulmonary outcomes than functional outcomes in status epilepticus

**INTRODUCTION**

Physical therapy is used in the intensive care unit to minimize respiratory complications and altered level of consciousness. In patients on mechanical ventilators with traumatic brain injury leads to secondary pulmonary and functional deficits. Most of the patients develop severe compromise in the steps of oxygenation, oxygen delivery; consumption and extraction by the tissue the clinical outcome of physiotherapy are sparsely available.

**Background and Need**

Status epilepticus define as Continuous seizures or repetitive, discrete seizures with impaired consciousness in the inter-ictal period, duration of seizure activity should be 15-30 min and it remains one of the most complex and common clinical problems in ICU. The incidence of status epilepticus in developed countries is between 17 and 23/100,000. According to some series, up to one-third of patients suffering from status epilepticus may present with neurogenic pulmonary oedema (NPE) symptoms [1]. According to some authors, distant organ effects of apparently isolated injuries to the lungs, gut, and kidneys have all been discovered in recent years<sup>4</sup>. Several studies have shown that the status epilepticus is the major cause of NPE leads to respiratory complications and increased mortality risks [2, 3, 4, 5]

Acute lung injury (ALI) and the acute respiratory distress syndrome (ARDS) are characterized by rapid-onset respiratory failure following a variety of direct and indirect insults to the parenchyma or vasculature of the lungs, ALI as respiratory failure of acute onset with a PaO<sub>2</sub>/FiO<sub>2</sub> ratio ≤300 mmHg (regardless of the level of positive end expiratory pressure, PEEP), bilateral infiltrates on frontal chest radiograph, ARDS was defined identically except for a lower limiting value of <200 mmHg for PaO<sub>2</sub>/FiO<sub>2</sub>. There exists complex interaction between brain and other distant organs mainly those by the immune mechanisms and systemic inflammatory mediators The lung injury in brain injury was found to be worsen with prolonged ventilation and delayed weaning[11]. People with status epileptics face major ongoing problems such as long term physical disabilities, the complex cognitive, behavioral and personality sequelae are commonly the most disabling problems.[10

The effect of various form of physiotherapy intervention such as chest physical therapy, early mobilization and therapeutic

exercises are widely studied and found to improve conscious level, functional activity and reduce ventilator dependency and the length of stay in an intensive care unit [13, 14, 15]. In patients on mechanical ventilators with status epilepticus induced neurogenic pulmonary oedema is a common clinical diagnosis which is leading to secondary pulmonary deficits. The respiratory physiotherapist working on the intensive care unit often encounters patients with acutely injured lungs[18] The temptation is to treat these patients conventionally using a combination of suction, positioning and manual hyperinflation, the aim being to improve arterial blood gases and pulmonary compliance by the clearance of retained large airway secretions and the recruitment of peripheral lung units

**CASE PRESENTATION**

A 37 years old man, was admitted to the emergency department after experiencing a multiple generalized seizure episode with Loss of consciousness and normal chest radiograph findings. The blood gas shows hypoxemia PaO<sub>2</sub>. He had a surgical history of left Decompressive craniotomy done on 30<sup>th</sup> November 2015 followed ventriculo peritoneal shunt at (6<sup>th</sup> February 2016) and cranioplasty done on 10<sup>th</sup> May 2106.

The critical care team facilitated a rapid admission to the high dependency unit. Elective intubation was inevitable. Ventilatory and oxygen requirements continued with Assist control mode and a FiO<sub>2</sub> of 0.8 (fraction of inspired oxygen) PEEP 8 cm H<sub>2</sub>O (Positive end expiratory pressure) was commenced. Physiotherapy treatment centered on positioning and ventilation/perfusion (V/Q) optimization.

On the day of examination the patient GCS 4/15, mode of ventilator support A/C (Assist control), FiO<sub>2</sub> (fraction of inspired oxygen), PEEP 8 cmH<sub>2</sub>O, PO<sub>2</sub> 50.6, the oxygenation index is 63.2, (A-a) gradient is 477.4. Attitude of limb: (B/L) Upper limb: shoulder adducted and elbow extended, wrist and finger flexion, Lower limb: Hip joint – externally rotated (B/L) Knee joint – flexed, Feet – plantar flexed (B/L) Muscle tone normal in all four limbs, sensory and motor examination done later, reflexes

	RIGHT	LEFT
KNEE	Exaggerated	Normal
ANKLE	Exaggerated	Normal

On auscultation: Right side basal bronchial breath sounds, left basal crepitation present

**METHODOLOGY**

This is a single case study to analyze role of integrated physical therapy intervention on pulmonary and functional outcome in a patient with status Epilepticus the study was conducted SRM medical college hospital and research institute Chennai, the subject was taken from a Neuro - surgical intensive care unit.

**PHYSIOTHERAPY INTERVENTION**

**Procedure:**

The ICU patients who referred for physiotherapy were included for the study after the obtaining informed consent from the patient / patient care taker. The Pulmonary outcomes such as the changes in the Arterial Blood Gases theoxygenation index [OI= (Pao<sub>2</sub>/Fio<sub>2</sub>)] and Alveolar-arterial difference in Oxygen saturation [(A-a) gradient] , Pao<sub>2</sub>, Fio<sub>2</sub>, PEEP, Mode of ventilator support, chest x ray , functional parameters such as (functional independent measures (FIMS), Disability rating scale (DRS) and GCS were noted up to discharge The patients values were analyzed to ascertain the level of improvement in the oxygenation and functional level .

During the mechanically ventilation physiotherapy consisted of critical care chest care in terms of physiotherapy including position giving technique (left lateral, supine, and right lateral), chest wall percussion, vibration, Manual hyperinflations and airway aspiration tracheal suctioning done at every 3 hours. Reduction of sedation elicited an effective cough reflex facilitating clearance of secretions. Limb care primarily involved passive range of movement exercises with attention to joint range of movement and muscle length.

**PROTOCOL**

**DAY 1 TO 2**

Right and left lateral positing along with chest vibration, Percussion, manual hyper inflations along with tracheal suctioning done thrice daily Passive range of motion all four limbs thrice daily. DAY 3 TO 9

Chest physiotherapy, limb care and mobilization continued same as above mentioned.

Mobilize the patient to dangling in the bed with Philadelphia cervical collar, twice daily with pre and post vitals are noted.

Day 9 tracheostomy was done

**DAY 10 TO 13**

Day 10<sup>th</sup> patient slowly improved conscious level and obeying commands, were neck control has slowly improve, withdrawal of cervical collar.

Additionally the patient had developed neck control and hip control, made him to high sitting and standing with support and chair sitting done.

**DAY 14 TO 17**

Patient conscious, obeying commands and co-operative, the patient respiratory status has improved gradual weaning from the ventilator. The patient can tolerate intermittently without ventilators support.

Routine Chest physiotherapy continued, active assisted exercise to left upper and lower limbs, pelvic bridging exercise, and passive exercise to right upper and lower limbs.

Along with patient made high sitting, sit to stand practice with support given and mobilize to chair sitting done additionally to tactile and auditory stimulation was given.

Day 18 patient transferred to Neuro sugary special ward.

**REASSESSMENT**

**SUBJECTIVE**

Mode of ambulation: wheelchair  
Body built: Mesomorphic

**Attitude of limb:**

Upper limb: right side shoulder adduction, internal rotation, elbow, wrist and finger flexion, left side shoulder adduction, elbow extension, finger flexion.

Lower limb: right side Hip joint – externally rotated, Knee joint – flexed, Feet – Plantar flexed, left side knee extension, ankle neutral.

**MUSCLE TONE**

Upper limb (Right): Grade 2 (According to modified Ashworth's scale)

Lower limb (Right): Grade 3 (According to modified Ashworth's scale)

**DTR REFLEXES**

	RIGHT	LEFT
KNEE	Exaggerated	Normal
ANKLE	Exaggerated	Normal

**PLANTAR REFLEX:** Right side extensor response, Left side flexor response

**SENSORY EXAMINATION:** Intact

**MOTOR EXAMINATION**

**VOLUNTARY CONTROL**

SIDE	RIGHT	LEFT
UPPER LIMB	GRDE 0	GRADE 5
LOWER LIMB	GRADE 0	GRADE 5

**MUSCLE POWER**

SIDE	RIGHT	LEFT
UPPER LIMB	Acute hemiplegic limb	3/5
LOWER LIMB	Acute hemiplegic limb	4/ 5

On auscultation: Bilateral basal crepitation present

**DAY 18<sup>TH</sup> TO 30<sup>TH</sup>**

Chest care continued, limb care such as stretching, passive range of motion to right upper and lower limb, strengthening Active range of motion exercise left upper and lower limb.

Pelvic bridging, rotation done

High sitting with support in the cot and made him sit to stand exercise given.

Wheelchair mobilization.

**DAY 31<sup>ST</sup> TO 56<sup>TH</sup>**

Chest and tracheostomy care continued.

Passive stretching, range of motion exercise to right upper and lower limb, active exercise to left upper and lower limb, Pelvic bridging on one leg, Sit to stand (on cot) with assistance walker, Number of session increase every second hourly.

**DAY 57<sup>TH</sup> TO TILL DISCHARGE**

Day 57<sup>th</sup> tracheostomy decanulation done

Chest physiotherapy, coughing encouraged spitting salivary secretions

Deep breathing exercise, Incentive spirometry<600cc/sec, ballooning exercise every second hourly

Patient made him quadriped position with maximal support twice daily.

**REASSESSMENT**

**SUBJECTIVE**

He was able to do deep breathing exercise, incentive spirometry, and ballooning exercise

Patients started doing his self -care such as eating, grooming, and brushing by him.



**MADE TO STANDING**

**INCENTIVE SPIROMETRY**

**BALLOONING EXERCISE**

**DATA ANALYSIS**

The changes in the parameters were noted for everyday and the pulmonary and functional outcomes in status epilepticus patients receiving chest and limb physiotherapy and early mobilization were analyzed after the raw data was taken from day of physiotherapy received to till discharge.

**RESULTS AND DISCUSSION**

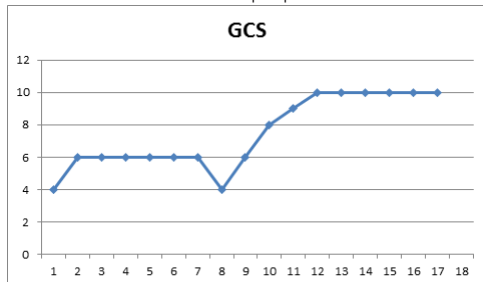
The purpose of this case study was to present the effects Role of integrated physical therapy intervention on pulmonary and functional outcome in a patient with status Epilepticus the patient tolerated the prescribed interventions very well. The positive results of oxygenation parameters than functional parameters there has been a modest improvement in consciousness level, our results support the efficacy and need for integrated PT intervention for this patient.

**Figure 1: Day Wise - Changes in GCS Level**

DAYS	GCS
1	4/15
2 - 7	6/15
8	4/15
9	6/15
10	8/15
11	9/15
12 -57	10/15
58 -62	15/15

**GCS level**

The GCS level and have improved from day1 through day of discharge , A change in posture from supine to sitting position adds exercise and gravitation stress to the body. Thus, the sitting position might stimulate RAS (Reticular activating system) and improve consciousness level in patients with cerebral disorders (Takashi Moriki et al., 2014). Improvement in conscious level has more benefitted with physiotherapy in early mobilization in intensive care unit even in status epilepticus.



**GRAPH 1: DAY WISE CHANGES IN GCS LEVEL**

**OXYGENATION PARAMETERS**

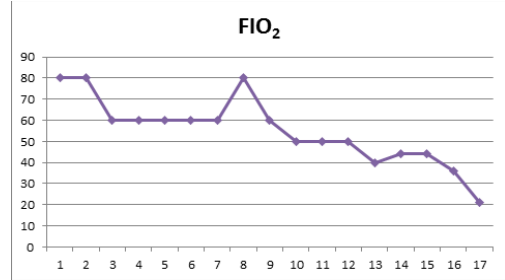
**Figure 2: Day Wise - Changes In Oxygenation Ventilatory Parameters Oxygenation Ventilatory Parameters**

DAYS	MODE OF VENTILATOR SUPPORT	PEEP	FIO2
1-2	A/C	8	80
3-4	SIMV	6	60
5-6	T PIECE	5	60
7-8	A/C	5	80

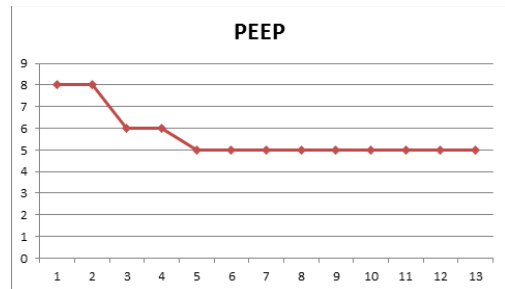
9-10	SIMV	5	50
11-12	SIMV	5	50
13-14	TPIECE	5	44
15-16	TPIECE		36
17	RA		21

Oxygenation levels in ventilator parameters

The mode of ventilator support, FIO2 and PEEP have improved from day1 through day 17. Weaned from the ventilators, the improvement shows that the invasive mechanically ventilated patient with status epilepticus are more prone to affected neurogenic pulmonary edema induced ARDS and ALI and more benefitted with chest physiotherapy even in distant organ injury.



**GRAPH 2: DAY WISE CHANGES IN FIO2 LEVEL**



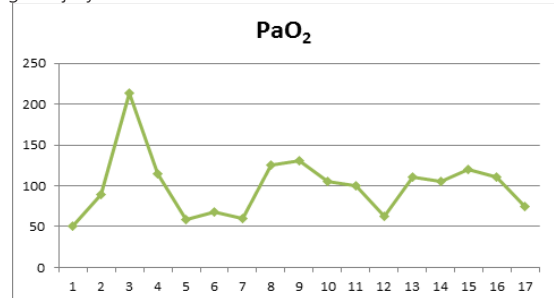
**GRAPH 3: DAY WISE CHANGES IN PEEP LEVEL**

**FIGURE 3: DAY WISE - CHANGES IN OXYGENATION ABG PARAMETERS**

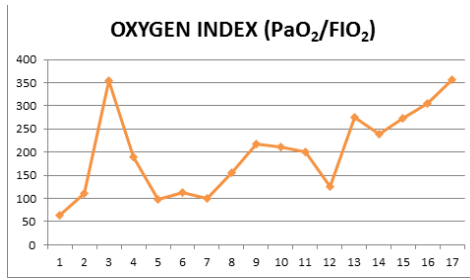
DAYS	PO2	OXYGENATION INDEX(OI)	(A-a)GRADIENT
DAY 1-2	89.1	111.3	430.8
DAY 3-4	114	190	260
DAY 5-6	68.2	113.6	321.7
DAY 7-8	125.4	156.7	400.2
DAY 9-10	105.4	210.8	213.8
DAY 11-12	62.9	125.8	243.5
DAY 13-14	105	238.6	155.6
DAY 15-16	110	305.5	82

Oxygenation levels in ABG parameters

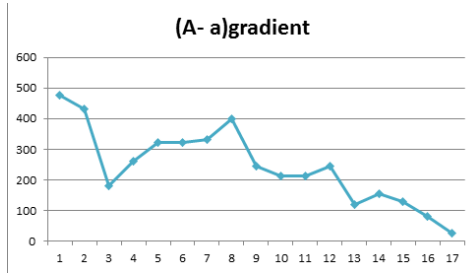
The PaO<sub>2</sub> level, Oxygenation Index and (A-a) gradient have improved from day1 through day 17. The improvement shows that the status epilepticus patients more prone to affected ARDS and ALI and more benefitted with chest physiotherapy even in distant organ injury.



**GRAPH 4: DAY WISE CHANGES IN PaO2 LEVEL**

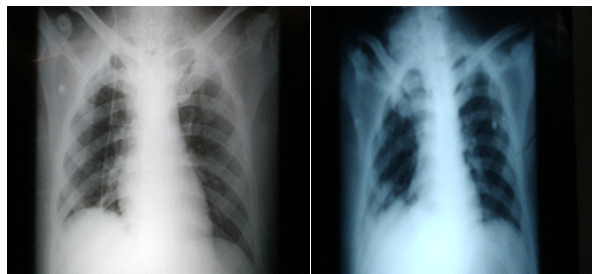


GRAPH 5: DAY WISE CHANGES IN OXYGENATIONS INDEX LEVEL



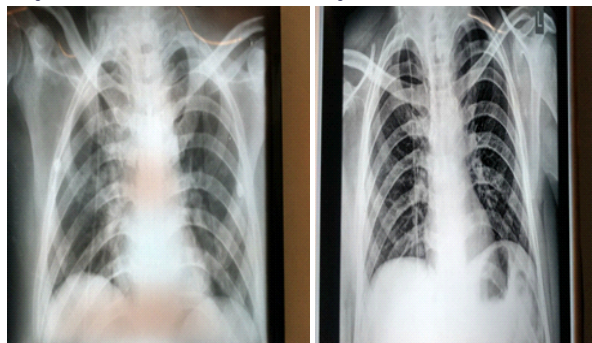
GRAPH 6: DAY WISE CHANGES IN (A - a) GRADIENT LEVEL

CHANGES IN CHEST X - RAY INTERPRETATION



PICTURE 1 Day of admission

PICTURE 2 Day 3



Day 17

Day of discharge

Chest x- ray interpretation in day wise improved from day of admission to till discharge. In the day of admission there is showing haziness in right upper lobe and basal areas than left basal areas followed day 3rd showed homogeneous opacities seen in right middle lobe and lower basal segment and basal collapse noted, day 17 significant improvement with mild basal haziness in right lower lobe and day of discharge clear lung field with normal cost phrenic angles noted which shows that chest physiotherapy has definite impact in improve bronchial hygiene in status epilepticus patients.

FIGURE 3: WEEK WISE - CHANGES IN FUNCTIONAL PARAMETERS

DAYS	FIMS	DRS
DAY 1	18	29
DAY 7	18	24
DAY 14	18	23

DAY 21	20	21
DAY 28	21	21
DAY 35	28	21
DAY 42	38	21
DAY 49	44	21
DAY 62	55	15

The functional outcome such as FIMS and DRS at admission and discharge are showed there is an improvement but not independent in all activities of daily living .The changes in functional parameters were showing that chest hygiene improvement alone could not improve brain functions in status epilepticus patients and functional Parameters are independent factors.

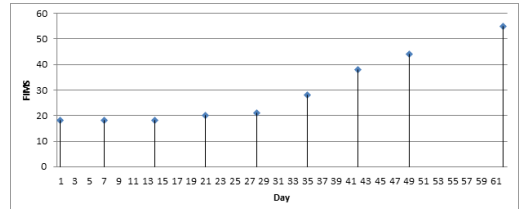


Figure 4: Week Wise-changes In Functional Parameters (fims)

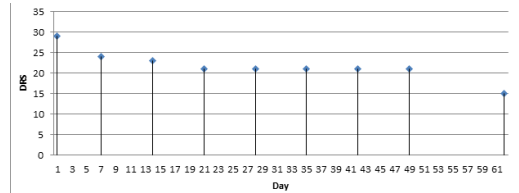


Figure 5: Week Wise-changes In Functional Parameters (drs)

CONCLUSION

Integrated physical therapy intervention has definite role in improving pulmonary outcomes than functional outcome and modest improvement in conscious level in patient with status epilepticus. However this needs to be verified in larger sample before generalization of these finding.

REFERENCES

1. Pelosi P, Rocco PR. The lung and the brain: a dangerous cross-talk. Crit Care 2011; 15:168.
2. Colice GL, Matthay MA, Bass E, Matthay RA. Neurogenic pulmonary edema. Am Rev Respir Dis 1984; 130: 941-8.
3. Simon RP. Physiologic consequences of status epilepticus. Epilepsia 1985; 26: 558-66.
4. Mulroy JJ, Mickell JJ, Tong TK, Pellock JM. Postictal pulmonary edema in children. Neurology 1985; 35: 403-5.
5. darnell JC, Jay SJ. Recurrent postictal pulmonary edema: a case report and review of the literature. 1982; 23: 71-83
6. Lopez-Aguilar J, Villagra A, Bernabe F, et al. Massive brain injury enhances lung damage in an isolated lung model of ventilator-induced lung injury. Crit Care Med 2005; 33:1077-1083.
7. Holland MC, Mackersie RC, Morabito D, Campbell AR, Kivett VA, Patel R, Erickson VR, Pittet JF: The development of acute lung injury is associated with worse neurologic outcome in patients with severe traumatic brain injury. J Trauma 2003, 55:106-111.
8. Hopkins RO, Gale SD, Weaver LK: Brain atrophy and cognitive impairment in survivors of acute respiratory distress syndrome. Brain Inj 2006, 20:263-271.
9. Kalabalikis P, Papazoglou K, Gouriotis D, et al: Correlation between serum IL-6 and CRP levels and severity of head injury in children. Intensive Care Med 1999; 25:288-292.
10. Helps y, henleyG, harrisonJ. hospital separations due to brain injury, Australia 2004-05. Adelaide: AIHW 2008 traumatic.
11. MinheeSuh ,Margaret Heitkemper, 2011 Chest Physiotherapy on the Respiratory Mechanics and Elimination of Sputum in Paralyzed and Mechanically Ventilated Patients With Acute Lung Injury: A Pilot Study critical care med. 5(1):60-69.
12. Takashi Moriki et al., Sitting position improves consciousness level in patients with cerebral disorders Open Journal of Therapy and Rehabilitation 1 (2013) 1-3.
13. Zanni JM, Korupolu R, Fan E, Pradhan P, Janjua K, Palmer JB, et al. Rehabilitation therapy and outcomes in acute respiratory failure: An observational pilot project. J Crit Care 2010; 25:254-262.