**Original Study**

# The role of Respiratory Physiotherapy in reductionof Chronic Pulmonary Infection Score (CPIS) in Acquired Brain Injury Patients admitted in Intensive Care Unit: A Comparative Study

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**Abstract**

It was accounted for ABI as damage to the brain which brings about disintegration in subjective, physical, enthusiastic and autonomous working. Acquired brain injury can occur due to injury, hypoxia, contamination, tumor, substance manhandle, degenerative neurological sickness and stroke1,2. Serious ABI is characterized as a GCS of 3-8 after cardiopulmonary revival in a patient with an irregular computer tomography (CT) output of the head which shows haematomas, wounds, oedema, and compacted basal cisterns3,4. The definitions gave in this passage were embraced for use in this ABI investigation. CPIS was used to diagnose and determine the incidence of VAP.

**Clinical pulmonary infection score(CPIS)-**

**Temperature(**$^{o}$C)

≥36.5and≤38.4=0point

≥38.5and≤38.9=1point

≥39or≤36=2points

**Blood leukocytecount (cells/mm$^3$)**

≥4,000and≤11,000=0point

<4,000or>11,000=1point+bandforms

≥500=+1point

**Trachealsecretions**

Scanty=0point

Moderate/profuse but not purulent = 1 point

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Moderate/profuseandpurulent=2point

**Oxygenation: PaO2/FiO2**

>240orARDS=0point

≤240andnoevidenceofARDS=2points

**Pulmonaryradiography**

Noinfiltrate=0point

Patchy/diffuse in filtrates=1point

Local is edinfiltrate=2points

**Culture of tracheal aspirate (semi-quantitative)**

Pathogenic bacteria cultured ≤ 1+ or no growth=0point

Pathogenic bacteriacultured>1+ornogrowth=1point

Same pathogenicbacteriaseen on Gramstain >1+=2points

**Totalscore = CPIS (possible range=0to12)**

**Methods:** Respiratory physiotherapy procedures assists to expand lung volumes, enhance gas diffusion, reduce work of breathing, reduce MV stay of patients and induce optimum recovery. In this the respiratory physiotherapy applications involved a regimen of Positioning, Manual Hyperinflation (MH), Airway Suctioning, PNF for Respiration, Passive Limb Movement protocol and Early Mobilisation protocol.

**Results:** The results shows that the Chronic Pulmonary Infection Score (CPIS) reduced from at the time of admission to at the time of discharge, the significance of P<.005

**Conclusion:** Respiratory physiotherapy managed Chronic Pulmonary Infection Score (CPIS) reduction from at the time of admission to at the time of discharge and improved the outcome of the ABI patients.

**Keywords:** Acquired Brain Injury, Moderate to Severe Head Injury, Respiratory Physiotherapy, Chronic Pulmonary Infection Score, Intensive Care Unit, Cognition, Conscious.

## Introduction

Acquired brain injury patients treated with mechanical ventilation (MV) usually develop Ventilator-associated pneumonia (VAP) that is aserious & complex health hazard. Pneumonia occurs due to microbial attack of the ordinarily sterile lower respiratory tract. The dominant part of pneumonia is that, this disease occurs due to potential pathogens that have colonized the oropharyngeal airway route. When VAP occurs the stay of patient on MV, the stay of patient in ICU and the stay of patient in hospital increases. There is a significant finding of ABI patients admitted in ICU may develop VAP, which could effect on ICU results. It has been generally shown that VAP in ABI patients induces huge, expanded expenses to the social insurance framework, an expanded danger of horribleness and mortality emerging.[5,6]

Respiratory physiotherapy interventions are a generally reasonable and broadly accessible administration technique that may profit patients in the ICU by reducing the rate of VAP and its related outcomes. Hypothetically respiratory physiotherapy reduce the stay on MV and improve ventilation which may decrease the frequency of VAP. In this way, respiratory physiotherapy may reduce the stay on MV, requirement of tracheostomy, expenses and hospital stay.[7]

## AIMS

This study aimed to provide the first comprehensive objective evaluation of the effectiveness of respiratory physiotherapy services for patients admitted to the ICU with ABI by:

- Investigating the clinical effectiveness

and cost effectiveness of respiratory physiotherapy interventions in reduction in CPIS, altering the incidence of VAP and other important clinical outcomes such as duration of MV and length of ICU stay.

- Providing justification of respiratory physiotherapy service provision to the ICU in terms of clinical effectiveness and cost effectiveness for patients with VAP following ABI.
- Providing validation of the required level of respiratory physiotherapy services and staffing in the ICU based on clinical outcomes

## Material and Methods

A prospective randomized study was done to assess the effects of respiratory physiotherapy on the incidence and resolution of VAP in patients admitted with ABI to the ICU at SH. The aim of Part A of the study was that the provision of regular prophylactic respiratory physiotherapy interventions along with routine medical and nursing care reduce the incidence of VAP. In part A of this study subjects were randomised.

In part A of this study male and female patients according to inclusion criteria received 24-hourrespiratory physiotherapy service (six interventions approximately every four hours throughout the day and night) along with routine medical and nursing care, passive movements and early mobilisation.

The aim of part B of this study was that the provision of regular respiratory physiotherapy interventions along with routine medical and nursing care influenced the progression and/or resolution of VAP.

Subjects from part A who developed VAP were transferred to Part B of the study based on inclusion criteria as outlined in dependent variable.

In part B of this study male and female patients according to inclusion criteria received 24-hour respiratory physiotherapy service (six interventions approximately every four hours throughout the day and night) along with routine medical and nursing care, passive movements and early mobilisation.

**Subjects**

ABI patients admitted to the ICU at SH who satisfied the inclusion criteria were eligible for participation in the study.

**Inclusion Criteria**

Inclusion criteria comprised of the following:

- Age between 16-85years[8]
- GCS less than or equal to nine (≤) 9 on admission to the SH ICU
- Presence of an ICP monitor or drain
- Invasive mechanical ventilator support for greater than twenty four hours (>) 24 hours
- Eligible subjects were prospectively randomised to a study group on admission to the SH ICU

**Exclusion Criteria**

Exclusion criteria comprised of the following:

- Patients on active therapy
- Patients with excessive respiratory support as:

Nitric oxide ventilation, Fraction of inspired oxygen [FiO2] > 0.8, Positive end expiratory Pressure [PEEP] >10 centimetres of water [cmH2O].

- Patients with excessive oxygen consumption they would not receive MH, Positioning and Airway suctioning according to SH ICU standard operating policy.
- Patients with unstable haemodynamic status as:

  ⇒ MAP [in millimetres of Mercury (mmHg)] > 120 or <60

  ⇒ HR (in beats per minute) > 120 or < 60

  ⇒ Labile MAP or HR

  ⇒ Presence of new cardiac arrhythmias

  ⇒ Excessive inotropic support as Noradrenaline or Adrenaline infusion at > 30 milligrams per hour

These MAP and HR criteria are based on greater than 10 percent change from the normal range[9]. In the ABI patients optimization of tissue perfusion and

cerebral oxygenation level may be a special issue if significant change occur from the normal level. Exclusion criteria based on the clinician's clinical experience, the dosage of vasoactive drugs titrated according to patient's body weight and clinical effects.

Patients with unstable neurological status as:

- Labile ICP or CPP,
- Sustained ICP > 25 mmHg,
- Sustained CPP <70 mmHg.

The primary focus of ICU management of ABI patients is to prevent secondary cerebral damage characterised by a reduction in cerebral perfusion pressure due to hypotension and hypoxia[10]. The above neurological criteria are from the Brain Trauma Foundation management guidelines[11].

For the purpose of this study 'labile' was considered as a clinically significant changes in any of: MAP, HR, ICP and CPP of 20 per cent or more of normal values required definitive intervention. MacIntyredescribed an acute increase or decrease in blood pressure at least 20 percent is indication of haemodynamicinstability[12].

## Results and Discussion

**Table 1: Demographic and clinical characteristics of the study subjects**

| | |
|---|---|
| Age (in years) | |
| Mean ± SD | 45.54 ±11.56 |
| Median (Range) | 47 (21 – 78) |
| Gender | |
| Male | 82 (71.9%) |
| Female | 32 (28.1%) |
| Residence | |
| **Urban** | 67 (58.8%) |
| **Countryside** | 47 (41.2%) |
| **BMI** | |
| **<25 Kg/m$^2$** | 28 (24.6%) |
| **25 – 29 Kg/m$^2$** | 60 (52.6%) |
| **≥30 Kg/m$^2$** | 26 (22.8%) |
| **Reason for admission** | |
| **Assault** | 5 (4.4%) |
| **ICH** | 29 (25.4%) |
| **MBA** | 27 (23.7%) |
| **MVA** | 27 (23.7%) |
| **SAH** | 26 (22.8%) |
| **Comorbidity** | |
| **H/O COPD** | 70 (61.4%) |
| **Smoking** | 53 (46.5%) |
| **Chronic sputum production** | 49 (43%) |

Table 1. shows demographic and clinical characteristics of the study subjects

According to the objectives of this study the comparison of the groups determines that the randomization process was followed on the basis of inclusion criteria. In the treatment there were significantly more males than females. Results of the Levene's test defined that equality of changes between the groups based on demographic variables. The Levene test checks whether several groups have the same variance in the population. Levene test is therefore used to test the null hypothesis that the samples to be compared come from a population with the same variance.

**Table 2: Comparison of CPIS among study subjects**

| Time | CPIS | Mean difference | Test of significance |
|---|---|---|---|
| At admission | 4.15±0.50 | 1.85±1.45 | t=13.61 at 113 df, |
| At discharge | 3.30±1.33 | | **P<0.001 (S)** |

Table 2 shows that CPIS score reduced from at the time of admission to at the time of discharge among study subjects. Thus level of significance p 0.005.

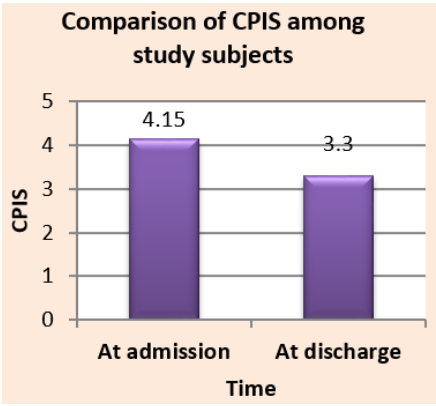


**Fig 1: Comparison of CPIS of study subjects at the time of admission and at the time of discharge**

## Discussion

This segment of the Discussion defines the occurrence of VAP in form of CPIS score, term of stay on MV and length of ICU stay. The numbers of patients of ABI was 114 who satisfied inclusion criteria assessment. Respiratory physiotherapy particularly focus on the distinguished causes of VAP. Various elements and occasions are responsible for course of pathogenesis of VAP. In ICU the arrangement of Respiratory physiotherapy required where premorbid factors like age, smoking and seriousness of ABI induces endotracheal intubation of patients.[13]

Physiologically the prophylactic respiratory physiotherapy helped to change the rate of VAP with clearance of airway route, enhancing oxygenation and lung consistence, that's why lower respiratory tract has not been imperiled with microscopic organisms.

## Conclusions

The impact of prophylactic respiratory physiotherapy reduced CPIS score in acquired brain injury patients from at the time of admission to at the time of discharge[14,15]. The fundamental conclusion from this study was that the utilization of 24-hourrespiratory physiotherapy service (six interventions approximately every four hours throughout the day and night) along with routine medical and nursing care, passive movements and early mobilization reduced occurrence of VAP, stay on MV and stayof ICU of ABI patients in ICU at SH. When criticalillness ICU parameters were assessed with clinical factors the arrangement of a prophylactic respiratory physiotherapy regimen is recommended intentional to avoid VAP in ABI patients. The study provides comparison between subject's CPIS score at the time of admission and at the time of discharge. Subjects those developed VAP were significantly male and admitted with a lower GCS. Duration of MV, length of ICU stay and length of hospital stay were significantly increased in subjects with VAP.[16,17,18]

**Conflict of interest**- Nil

**Source of Funding**- Self

**Ethical clearance**- Ref no.06/ EC/RENEW/ INST/2021/12208

SOLANKI HOSPITAL INSTITUTIONAL ETHICS COMMITTEE

**Consent:** Informed consent was taken from all participants in the study for publication work in the journal. If patient was conscious then consent was read and signed by himself or herself. If patient was not conscious then his/ her LAR read and signed the Informed consent.

**Abbreviations**

| | |
|---|---|
| ABI | Acquired Brain Injury |
| GCS | Glasgow Coma Scale |
| RLA-R | Rancho Los Amigos revised Scale |
| CT | Computer Tomography |
| PNF | Proprioceptive Neuromuscular Facilitation |
| ICU | Intensive Care Unit |
| VAP | Ventilator Associated Pneumonia |
| SH | Solanki Hospital |
| ICP | Intracranial Pressure |
| MAP | Mean Arterial Pressure |
| HR | Heart Rate |
| CPP | Cerebral Perfusion Pressure |
| ETT | Endotracheal Tube |

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