RESEARCH PAPER

Effectiveness Of Intensive Care Physiotherapy With Respiratory Muscle Training On Consciousness And Voluntary Control In Intraparenchymal Hemorrhagic Stroke

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ABSTRACT-

Background- One side of the body is affected in IPH stroke. Main impairment seen is chest complications the patient is dependent on a ventilator and has difficulty in weaning off.

Aim - To check the effect of intensive care Physiotherapy with respiratory muscle training on consciousness and voluntary control of respiratory muscles in intraparenchymal hemorrhagic stroke

Methodology – 30 participants were chosen. 15 were randomly allotted in the control and the experimental group. Group A was given intensive care Physiotherapy while Group B was given conventional with respiratory muscle training. Both groups were assessed at baseline (Day 1) re-evaluated on the last day of the intervention (Day 7) using GCS and APACHE II.

Results – Group A showed notable changes in GCS increasing from 3.8 to 11.8 and APACHE II score reducing from 39.5 to 13.26. While Group B showed a remarkable change in GCS increasing from 3.2 to 12.6 and APACHE II score reducing from 42.06 to 11.6 ($p<0.0001$). Between the groups analysis confirmed statistically superior outcomes in the experimental group preferring a combination of both techniques

Conclusion- The current study concludes that respiratory muscle training in addition to intensive care Physiotherapy improves consciousness and voluntary control in IPH.

Keywords- Chest PNF, Stroke, Intensive care, Physiotherapy, Respiratory muscle training.

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INTRODUCTION

Stroke or brain attack is the sudden loss of neurological function caused by an interruption of the blood flow to the brain which is the fifth leading cause of disability and the fourth leading cause of death in India[1]. The brain receives and regulates blood from the arteries that form the Circle of Willis. The main and most important function of the circle of Willis is that it works as a compensatory mechanism, when and if any occlusion or stenosis occurs in the internal cerebral artery or vertebral artery[2]. If there is any interference of flow in any one part of the artery, the patient can undergo a stroke[3]. There are two major classifications of stroke, ischemic and hemorrhagic stroke. Ischemic stroke which occurs when a clot blocks or impairs blood flow depriving the brain of essential oxygen and nutrients. Hemorrhagic stroke occurs when there is a rupture in an artery due to which the intracerebral pressure increases[1] which causes reduction in cerebral perfusion[4]. Intraparenchymal hemorrhagic strokes accounts for 10-20 percent of hemorrhagic strokes[5]. An intraparenchymal haemorrhage occurs in the deep structures such as brainstem, basal ganglia, internal capsule and cerebellum[6]. In a coagulopathic IPH the hematoma expands for up to 24 hours and in a non coagulopathic IPH for about 6 hours. Following this, perihematomal edema peaks at 72 hours which triggers secondary neuronal damage[7]. A patient with persistent hypertension and vascular changes can be one of the causes for an intraparenchymal haemorrhage. Due to IPH there is increase in the intracerebral pressure

which can cause compression of various brain structures which can lead to impaired consciousness [8-9].To understand and analyze the cerebral status of the patient in terms of consciousness, Glasgow Coma scale can be used which takes into consideration eye, verbal and motor response 3 being the minimum scoring which corresponds to maximum impairment[10]. Along with the GCS **s**coring, APACHE II scale does a comparative analysis, taking all factors into consideration and can help in understanding if the patient has to be ventilated and when is the ideal time to wean the patient off the ventilator[11].. There are two main reasons to intubate a patient one is their neurological status is compromised to such an extent that the brain is unable to send appropriate signals to maintain a good oxygen profusion and the other reason being that chest complication are restricting adequate ventilation.[12]. Intubated patients encounter various chest complications that arise due to the weakened respiratory muscles of the affected side, which result in accumulation of secretion and reduced chest expansion[13-14]. During this hospital stay, the patient is treated and given necessary intensive care limb and chest physiotherapy. Chest physiotherapy which primarily include percussion, vibration and shaking focus on centralizing the secretions which can facilitate expulsion of secretion through suctioning. In addition, chest PNF such as intercostal stretch, vertebral pressure, co-contraction of abdomen and perioral pressure use a reflexive response which will be triggered by an external proprioceptive and tactile stimuli which will assist respiration. This in turn will aid in expelling secretions as an involuntary cough response will be elicited and ensure that there is adequate chest excursion which will enhance chest mobility[15]. Alongside ensuring that the chest aspect of the patient is clear, working on the limb physiotherapy including range of motion exercises to all joints has great importance to ensure that the integrity of the muscle is maintained and to prevent atrophy and contractures in the muscles Limb physiotherapy in adjunct with facilitatory techniques such as joint approximation, tapping and quick stretch work in towards increasing the tone by providing a facilitatory stimulus to particular muscles[16]. Therefore, this study emphasizes on understanding the effect of intensive care physiotherapy with respiratory muscle training on consciousness and voluntary control in intraparenchymal hemorrhagic stroke patients.

MATERIALS AND METHODS

A total of 33 patients were taken into the study, both genders from the age of 18 to 74 were enrolled in the study. All participants had a GCS below 8 and a high APACHE II score from 35 to 40. This study excluded subject who had a GCS more than 8, a low APACHE II score and those who encountered polytrauma (clavicle or rib faracture). Approval for this study was granted by the ethical committee of Krishna Vishwa Vidyapeeth. (Protocol Number- 029/2023-2024). Informed consent was taken from the family members of the respective subject.

PROCEDURE

The study was conducted from 2023-2024 at Krishna Charitable Hospital, Karad. The study population was chosen on the bases of the inclusion and exclusion criteria who have suffered from Intraparenchymal hemorrhagic Stroke and have Glasgow Coma Score less than 8 were chosen in the study. Patients who have a Glasgow coma scale more than 8 were excluded from the study. The relatives of the participants who were chosen for the study were well versed about the treatment approach and an informed consent was taken. The sample size was 30, enrolled were 63 samples as the drop-out rate was high and the availability of the samples were high completed samples were 30. Group A was given conventional treatment which included routine ICU management which consisted of Chest Physiotherapy, Limb Physiotherapy and positioning. Group B which was the experimental group was given respiratory muscle training which included Chest PNF and Dofin breather once the patient was extubated in addition to the conventional management. All the patients received treatment sessions, twice a day, 6 days per week, lasting for an average of about 30 minutes. Treatment was given for one week.

OUTCOME MEASURES

1. Glasgow Coma Scale-

The scale is a standard and an easily- interpretable scale to understand the neurological status of a patient. Inter reliability is 0.86. This scale is used to assess the level of consciousness. These are three component in this scale. One to understand the eye response, second the verbal response and lastly the motor response. While examining a patient with this scale the therapist has to first call out to the patient and tap the patient. If there is no response then the therapist has to induce a pain stimulus to understand the level of consciousness of the patient. There are various parts where even a little pain can inflict

a reflex. The two most common sites are, performing a sternal rub and pinching the ear lobe. Once these stimuli are provided the therapist has to see if there are any response in each of the component. The minimum score that a patient can acquire is 3 which is no response in all three components of the scale. If the patient has a score which is less than 8 it indicates a severe brain injury. 9 to 13 indicates moderate head injury and 13 to 15 is mild head injury[10].

2. APACHE- II

This scale is a great assistance for understanding the ideal time when a patient has to be intubated or extubated. The patient has to be in the optimal state taking all factors into consideration when extubating. If the patient is extubated too quickly the oxygen saturation can drop which can result in re-intubation. This scale takes into consideration age, vitals, sodium, potassium, creatinine, renal function, white blood cells, hematocrit and if the patient is intubated or not. This scale helps in understanding the prognosis of the patient and when is the appropriate time to extubate a patient[17].

EXERCISE INTERVENTION

The **control group** was given conventional management which included chest physiotherapy such as chest percussion, vibration and shaking followed by suctioning according to the patient needs. The patient was also given limb physiotherapy such as passive range of motion exercises, followed by facilitatory techniques such as fast tapping, fast brushing and joint compression and positioning ever two hours

The **experimental group** was given the conventional treatment in addition to the chest PNF which included intercostal stretch, anterior stretch basal lift, co-contraction of the abdomen which helped in increasing and aiding in the stimulation of the cough reflex which helps in the expulsion of secretions. Once the patient is extubated and can follow commands the patient is given the dofin breather which helps in activating both the inspiratory and expiratory muscles of the chest.

Fig 1- Upper limb ROM Exercises

Fig 2- Lower Limb ROM Exercises

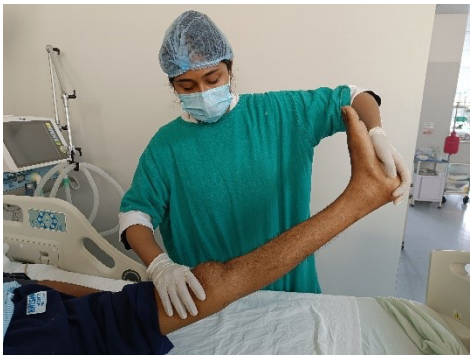


Fig 3- Heavy Joint Approximation

Fig 4 – Chest Percussion

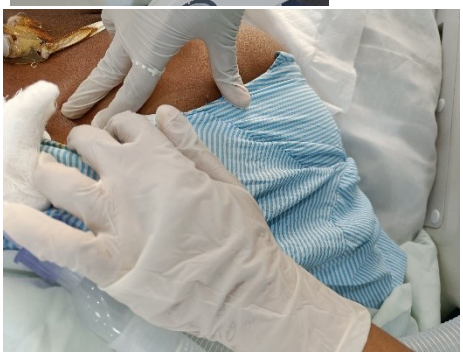


Fig 5 – Co-contraction of Abdomen **Fig 6 - Intercostal Stretch**

Fig 7 - Patient using Dofin Breather Trainer

STATISTICAL ANALYSIS

The necessary data was obtained on the first and last day of the set treatment protocol which was then charted in an excel sheet and SPSS software was used to perform the statistical analysis. Pre and post values were noted within the group and between the groups. The level of significance was set at $p<0.05$.

RESULTS

Interpretation – Table 1- shows the description of number of participant that are male and female who were a part of this study. Out of which only 30 completed the study. The pre and post values of GCS in the conventional group **(Table 2 and Graph1)** shows a very significant p value < 0.0031 and **(Table 3 and Graph 1)** the APACHE II score shows a p value of less than 0.007 which is also very significant. The interpretation of the pre and post values of the experimental group has a p value of 0.0001 which is extremely significant for the comparison of the GCS outcome measure **(Table 4 and Graph 2)** and the p value for the comparison of the APACHE II score is extremely significant with a p value of 0.0001 **(Table 5 and Graph 2)**. The comparison in between groups comparing the post values for GCS and APACHE II score with a p value of 0.0001 seen, which is extremely significant **(Table 6 and Graph 3)**

Table 1 - Gender distribution in the study

Gender	Number of patients
Male	43
Female	20
Total	63

WITHIN THE GROUP ANALYSIS

TABLE 2 – Pre and Post values of Group A. Glasgow Coma Scale

GCS	Pre	Post	P value	F value	Inference
Group A	3.8 ±1.207	11.8 ± 0.5	0.0031	5.46	Very significant

TABLE 3 – Pre and post Values of Group A. APACHE II Score

APACHE	Pre	Post	P value	F value	Inference
Group A	39.5 ± 6.9	13.26	0.007	4.62	Very significant

		±3.2			

Graph 1: Pre and Post values of Group A. Glasgow Coma Scale and APACHE II

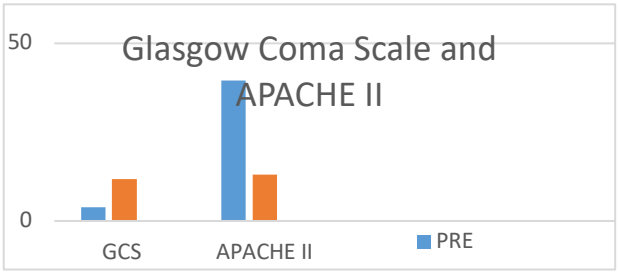


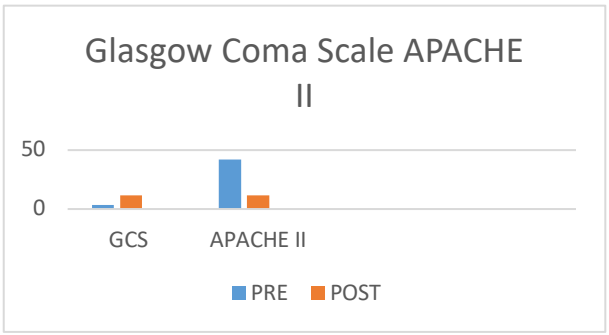
TABLE 4 – Pre and Post Values of Group B. Glasgow Coma Scale

GCS	Pre	Post	P value	F value	Inference
Group B	3.2 ±0.4	12.6 ± 1.3	0.0001	11.38	Extremely significant

TABLE 5 – Pre and Post Values of Group B. APACHE II score

APACHE	Pre	Post	P value	F value	Inference
Group B	42.06 ± 4.13	11.6 ±1.2	0.0001	11.06	Extremely significant

Graph 2: Pre and Post values of Group B. Glasgow Coma Scale and APACHE II

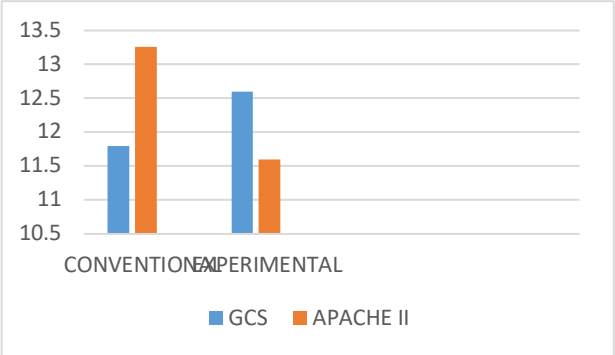


BETWEEN THE GROUPS ANALYSIS

TABLE 6 – Analysis between post Mean of GCS and APACHE II in group A and group B

	Conventional	Experimental	P value	T value	Degree of freedom	Inference
GCS	11.8 ± 0.5	12.6 ± 1.3	0.0001	0.52	28	Extremely significant
APACHE	13. 26 ±3.2	11.6 ±1.2	0.0001	2.52	28	Extremely significant

Graph 3: Post mean of GCS and APACHE II Score in Group A and Group B



DISCUSSION

This study was performed on 30 patients who were diagnosed with intraparenhymal haemorrhage. The experimental group showed an improvement in the consciousness and voluntary control of the patient post intervention. Both outcome measures had a P value of 0.0001 which was extremely significant. The experimental group intervention showed a better result in improving consciousness and voluntary control than the conventional group. Chest PNF techniques played a vital role in improving the GCS score and reducing the APACHE II score which assisted in weaning the patient off the ventilator.

The patients in the conventional group were given the standard intensive care protocol consisting of chest

physiotherapy which included percussion, vibration and shaking and limb physiotherapy which included passive range of motion, progression as and when required with facilitatory techniques. The experimental group was given the same protocol in addition, chest PNF including intercostal stretch, anterior lift basal stretch and co-contraction of abdomen and Dofin breather trainer were administered to the patients.

While administering Chest PNF intercostal stretch technique worked on activating the alpha motor activity which cause the muscle fibers to contract and relax. The intrafusal muscles of muscle spindle innervate the gamma motor neuron which regulate the sensitivity of the stretch reflex. The stretch is applied just before the patient inspires which has an effect on reducing the respiratory and heart rate and increasing the oxygen saturation[18-19].

Administering co- contraction of abdomen immediately elicited a cough reflex which in turn expedited in suctioning. Sherring et al Incorporated perioral pressure and co-contraction of abdomen which can help activate the parasympathetic system to induce a calming effect on the nervous system. Co-contraction of the abdomen is performed by compressing the abdomen when inspiration is performed, this causes an increase in intraabdominal pressure leading to an increase in the intrathoracic pressure which stimulates the cough reflex and increase cardiac output and venous return[20]. Dsilva R et al concluded in their systematic review that administering intercostal stretch anterior basal lift, perioral pressure and intra-abdominal pressure maybe aid in improving the respiratory status of a patient as the primary muscles of respiration gets facilitated while inhibiting the accessory muscles and expedite the cough reflex to expel secretions[21].

In addition to chest physiotherapy, the patient should be given limb physiotherapy. Hyun Ju Kim et al performed bilateral passive range of motion exercises for the upper limb to improve the functions and activities of daily living in stroke survivors. The patients were given a 15 min routine which as performed twice a day 5 times a day. The exercises performed consisted of passive range of motion exercises which helped prevent muscle shrinkage, lengthen muscle expansibility. These ROM exercises showed various effects such as reduction in edema when cross checked with the circumference at 2 and 4 weeks, which revealed positive results in comparison to the control group[22].

Asmita shinde et al. conversed the effects Range of motion exercises can be more effective when given in addition with facilitatory techniques. Roods theory can be applied while administering passive movements. The sensory manipulation can be benefitted to an unconscious patient as the sympathetic and parasympathetic affects the interpretation of sensory stimulus. Facilitatory techniques such as fast tapping and quick icing excites the arousal mechanism of the central nervous system, reducing the edema and facilitating the alpha motor system [10].

In addition to all the intervention, the rest period provided to the patient also has a crucial involvement in bettering the patient's condition. Positioning the patient is a way to continue the effects of the treatment administered. Proper positioning has a benefit on the chest aspect as well as the limb aspect of the treatment protocol. Positioning the patient can augment the centralizing of the secretions also prevention of contractures. Positioning a patient in side lying can aid in the centralizing the secretion of the upper lung and ensure more oxygen profusion in the lower lung. Ensuring that the neck and elbows in extension, while confirming that the lower limbs are internally rotated and safeguarding the ankle in neutral[23].

Administering a combination of chest physiotherapy including percussion, vibration, shaking and chest PNF, Limb physiotherapy and positioning of the patient every two hours showed extremely significant results in improving the consciousness of the patient and voluntary control of the patient in comparison to the control group. This study could be performed on patients in a larger scale and understanding the effects of various modes of ventilator to understand which chest PNF techniques has best effects in relation to the ventilator mode.

CONCLUSION

Chest PNF along with the conservative intensive care physiotherapy management has shown significant improvement in improving the voluntary control of the chest and the level of consciousness of the patient**.**

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CONFLICTS OF INTEREST STATEMENT

The authors affirm that they have no known conflicting financial interests or personal relationships that could have prejudiced the reported work.

DATA SHARING STATEMENT

All data analyzed during this study are included in this published article. Further details are accessible for noncommercial purposes from the corresponding author upon judicious request.

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