TO SEE THE EFFICACY OF HYPERBARIC OXYGEN THERAPY IN GROSS MOTOR ABILITIES OF CEREBRAL PALSY CHILDREN OF 2-5 YEARS, GIVEN INITIALLY AS AN ADJUNCT TO OCCUPATIONAL THERAPY

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INTRODUCTION

Hyperbaric Oxygen Therapy (HBOT) involves intermittent inhalation of 100% Oxygen under a pressure exceeding that of the atmosphere.

Cerebral Palsy is a form of Ischaemic Brain Injury where, Hypoxia causes leaking of blood vessels that eventually leads to Oedema, and Oedema further causes Hypoxia. HBOT interrupts this vicious cycle by providing an increased amount of Oxygen, which is necessary to heal these capillaries. Under normal conditions there is a limit to the amount of Oxygen that can be carried by the RBC's, however HBOT can not significantly increase the Oxygen carried by the RBC's, however HBOT dramatically increases the Oxygen carried in the blood plasma from 0.3ml/dl to 3-6ml/dl.

Besides, increasing Oxygen intake to the blood stream also reduces the permeability of blood vessels thereby reducing the Oedema and making the tissue "Oxygen rich". Scans indicate that post HBOT, capillary healing occurs, fluid leakage is reduced, swelling recedes, and effective blood supply is thus restored to previously Oxygen restricted brain tissue.

It is important to note that although some of the brain may be permanently damaged a large surrounding area may also be affected. This dormant area is often referred to as "Not dead but Sleeping" or Stunned Neural cells. It is believed that the high Oxygen levels that are attained in the body's cells during HBOT cause a physiological change to the cells of this dormant area effectively waking them up-thus, increasing the capacity for recovery.

It is also believed that contrary to the established medical belief, HBOT given early has the potential to effectively recover and rebuild brain tissue through reactivation of Stunned cells, revascularization and possibly stimulation of adult stem cells in the brain to repair existing Neural Pathways and grow new ones.

Just because the brain cells have recovered that does not mean it will function normally, therefore the purpose of this study is to educate and train the newly activated brain cells and revive the neuromuscular control by means of therapeutic exercises and activities.

REVIEW OF LITERATURE

Researches now clearly show dramatic improvements in symptoms of C.P. after HBOT. A study in Brazil revealed a 50% reduction in Spasticity of 94% (218 patients) of the patients involved in the study. Improvements have also been seen with vision, hearing and speech. (“Centro Brasilerio de Medicina Hyperbarica” 1985-1989)

In another study done on 26 C.P. children between 15 months to 5 years, 40 HBOT sessions at 1.5 ATA, twice daily, five days a week for 4 weeks was given. The result showed improvements in motor skills, attention, language and play. They further said that these children still have C.P. but have substantial improvements (CORNELL UNIVERSITY STUDY Dr. Maurine Packard,2000).

In a single case study with 15 months old severe Quadriplegic C.P. with critical vision impairment, HBOT was administered at 24 mm Hg for one hour, 33 treatment sessions over 3 week period showed moderate gain in the gross motor skills of these children. (Virginia S. Paleg, M.D., P.T.).

In a pilot study in 25 children with Spastic Diplegia C.P. with mean age 5.6 years (3.1 to 8.2 years) received 20 one-hour sessions of HBOT at 1.75 ATA. It demonstrated improvement in both gross motor and fine motor functions and also decrease in Spasticity and reduction in Deep Tendon Reflexes. (1999-2001 Chico Hyperbaric Centre.)

In another pilot study in C.P. children with average age of 41.8 months treated with 1.5 ATA HBOT was administered for 60 sessions for one-hour daily, five days a week. Results showed decrease in Spasticity and improvements in Gross motor and Fine motor functions. Functional reorganization in visual cortex also suggested by reappearance of visual evoked potentials. (Kevin F. Barrett MD, Kavan P. Corson CHt, Jon T. Mader MD)

HYPOTHESIS

H0: There is no relationship between the Gross Motor abilities and HBOT used as an Adjunct to Occupational Therapy in C.P. children.

H1: There is a significant improvement in the Gross Motor abilities of C.P. children by giving HBOT initially as an adjunct to Occupational Therapy.

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MATERIALS AND METHOD

1. 100% Oxyzen administered at 1.75 ATA (as approved by the FDA of USA for use in small children with C.P.) for 40 sessions for one hour daily, six days a week. [1 ATA (Atmospheric Absolutes)=760 mm Hg]


The informed consent was taken from the parents of 30 subjects and details of the procedure and the implications of the study were explained.

Physical Settings

1. HBOT was administered inside the Multiplace Chamber at Indraprastha Apollo Hospital, New Delhi.

2. Occupational Therapy treatment protocol was given at the premises of "UDAAN-for the Disabled", New Delhi.

Subjects

The study included 30 subjects that were randomly divided into two groups:

GROUP 1: Experimental Group=HBOT+O.T.
GROUP 2: Control Group=O.T. alone

Subjects Inclusion Criteria

1. Age Group 2-5 years, both sexes.

2. All types of C.P.

3. Mild to Moderate I.Q.

4. Those living in Delhi or willing to live in Delhi for 6 months with reasonable distance of UDAAN to facilitate daily transportation.

5. SPECT scan showing presence of recoverable penumbral.

Subjects Exclusion Criteria

1. Epilepsy, Bronchospastic disorders and E.N.T. disorders.

2. Genetic Disorders.

3. Pervasive Developmental Disorders.

DESIGN

An unmatched Subject Design was used in this Experimental Study.

Assessment

Baseline Gross Motor abilities were assessed initially and after six months of Occupational Therapy regimen using Norton's Basic Motor Evaluation Scale.

Protocol of Therapy

All 30 subjects were given one-hour of Occupational Therapy programme six days a week for a period of six months.

The therapy included:

1. Positioning.

2. Stretching exercises to maintain ROM.

3. Developmental Therapy to achieve higher milestones as relevant to the case.

4. Weight bearing on Upper Extremities (bilaterally) for 5 minutes each.

5. Active ROM activities of all joints.

Programme that was demonstrated to the parents included:

Home Based Therapy

1. Positioning.

2. Weight bearing on Upper Extremities (bilaterally) for 5 minutes each, twice daily.

3. Active ROM activities of all joints 5 times each joint twice daily.

RESULTS

Baseline characteristics were compared in Table 1 by "Student's t-test" and "Chi square test" as appropriate. As the Baseline Total Score (BTS) values were not comparable in Experimental and Control Groups, we used analysis of co-variance to compute means of Post Treatment Total Score (PTS) adjusted for imbalance in BTS.

Adjusted means of subjects were compared in Experimental and Control Group by "Student's t-test" in Table 2. In this Study, p<0.05 has been considered significant.

DISCUSSION

The study was primarily designed to see the efficacy of HBOT in Gross Motor abilities of Cerebral Palsy children of 2-5 years, given initially as an adjunct to Occupational Therapy. The results indicate that HBOT given as an adjunct to Occupational Therapy and Occupational Therapy alone are effective in improving Gross Motor abilities of C.P. children as evident from the difference between the means of Post Treatment Total score and Baseline Total Score of both the Experimental and Control Groups. But, the difference between the means of Post Treatment Total Score and Treatment Score in Experimental Group is significantly higher than the Control Group as evident in Table 1 & Table 2.

This is also supported by the SPECT scan and is in accordance with the results obtained by the researches done earlier with HBOT and Gross Motor abilities of C.P. children as mentioned in the Review of Literature.

Therefore it suggests that the rate of progress in Gross Motor abilities of Experimental Group is much faster than the Control Group. Thus the result of the study nullifies the Ho and proves the He.
### TABLE: 1

**BASELINE CHARACTERISTICS OF STUDY SUBJECTS**

<table>
<thead>
<tr>
<th></th>
<th>CONTROL GROUP (O.T.ALONE)</th>
<th>EXPERIMENTAL GROUP (HBOT+O.T.)</th>
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<tbody>
<tr>
<td><strong>Total No. of Subjects</strong></td>
<td>15</td>
<td>15</td>
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<tr>
<td><strong>SEX</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Girls</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>Mean Age (S.D.)</strong></td>
<td>3.66 (0.84)</td>
<td>3.48 (0.67)</td>
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<tr>
<td><strong>DIAGNOSIS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ataxia</td>
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<td>1</td>
</tr>
<tr>
<td>Athetoid</td>
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<tr>
<td>Diplegia</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Quadriperesis</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Baseline Total Score (BTS)</strong></td>
<td>20.86 (2.31)</td>
<td>27.06 (2.42)</td>
</tr>
<tr>
<td><strong>Mean (S.D.)</strong></td>
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### TABLE: 2

**MEAN (S.D.) OF PATIENTS ADJUSTED FOR BTS**

<table>
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<th>CONTROL GROUP (O.T.ALONE)</th>
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<tr>
<td><strong>Post Treatment Total Score (PTS)</strong></td>
<td>36.21 (2.02)</td>
<td>50.72 (2.01)</td>
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<td><strong>Mean (S.D.)</strong></td>
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<tr>
<td>'t' value</td>
<td>19.75</td>
<td>19.75</td>
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<tr>
<td><strong>Significance</strong></td>
<td>p&lt;0.001</td>
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Limitations

1. The present study was done on a small sample of 30 Subjects. Research on a large population would give more significant results.

2. HBOT is an expensive mode of treatment among Indian circumstances.

3. There is a variance of results due to subjects of different diagnosis, which was not the primary purpose of the study.

4. Matched subject design would have given better results.

CONCLUSION

HBOT enhances nerve cell regeneration and regrowth, starting about 4-6 months after starting therapy. Occupational Therapy treatment given during this phase magnifies the rate of Neurodevelopmental progress and significantly closes the gap between recognized growth patterns and observed growth rate, as compared to the children treated by the same therapists with the same Occupational Therapy protocol, at the same venue but without HBOT.

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REFERENCES


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