Study of the Role of Hyperbaric Oxygen Therapy in Autistic Children

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By

Marian Girgiss Risk

M.B., B.Ch. 2005
Faculty of Medicine
Ain Shams University

Supervisors

Prof. Dr. Farida El-baz Mohamed El-baz

Professor of Pediatrics
Faculty of Medicine, Ain Shams University

Prof. Dr. Yaser Abd El-Azem Abass

Professor of Radiology
Faculty of Medicine, Ain Shams University

Dr. Reham Mohamed Elhossiny Abd El-Basir

Lecturer of Pediatrics
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
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List Of Abbreviations

ABA: Applied Behavioral Analysis

AD: Autistic Disorder

ADHD: Attention Deficit Dyperactivity Diorder

AGE: Arterial Gas Embolism

AHI: Abelson Helper Integration

APA: American Psychiatric Associan

ARX: Aristaless Related Homeolox

ASD: Autistic Spectrum Disorder

ATA: Atmospheric Absolute

ATEC: Autism Treatment Evaluation Checklist

CHARGE: Coloboma of the eye, Heart defects, Atresia of the nasal choana, Retardation of growth, Genital abnormalities, Ear abnormalities.

CO: Carbon Monoxide

CP: Cerebral Palsy

CRH: Corticotrophin Releasing Hormone

CSF: Cerebrospinal Fluid

DS: Down Syndrome

DSC: Decompression Sickness

DSM-IV-TR: The Diagnostic and Stastical Manual of mental disorders, fourth edition, text revision

EEG: Electro Encephalo Graphy

EN: Engrailed

FDA: Food Drug Adminstration

FMR: Fragile X Mental Retardation

FXS: Fragil X Syndrome

HBOT: Hyper Baric Oxygen Therapy

HIF-1a: Hypoxia- Inducible Factor-1a

HLA:	Histocomptability Antigen
ICD-10:	International Classification of Diseases, 10th Edition
IG:	Immunoglobulin
IL:	Interlukin
IQ:	Intelligent Qoiecient
LC-NA:	Locus Cerelous-Noradrergic
MECP:	Methyl CPG Binding Protein
ML:	Milliletter
MR:	Mental Retardation
OCD:	Obsessive Compulsive Disorder
PDD:	Pervasive Developmental Diorder
PDD-NOS:	Pervasive Developmental Disorder-Not Otherwise Specified
PMN:	Polymorph Nuclear Lymphocytes
PTEN:	Phosphtase Tension
RNF:	Ringer Finger Protein
SPECT:	Single Postrion Emission Computrazied Tomography
SS:	Savant Syndrome
Th:	T Helper Cell
TNF:	Tumor Necrosis Factor
TSC:	Tuberos Sclerosis Complex
UBE:	Ubiquitin Activating Enzyme
UHMS:	Undersea, Hyperbaric Medicl Society
UK:	United Kingdom
USA:	United States of America
VEGF:	Vascular Endothelial Growth Factor
WHO:	World Health Orginazition

Introduction

Autism is a syndrome characterized by impairments in social relatedness and communication, repetitive behavior, abnormal movements, and sensory dysfunction *(Bernard et al., 2001)*.

Numerous studies of autistic individuals have revealed evidence of cerebral hypoperfusion, neuro-inflammation and gastrointestinal inflammation, immune dysregulation, oxidative stress, relative mitochondrial dysfunction, neurotransmitter abnormalities, impaired detoxification of toxins, and impaired production of porphyrins .Many of these findings have been correlated with core autistic symptoms. For example, cerebral hypoperfusion in autistic children has been correlated with repetitive, self-stimulatory and stereotypical behaviors, and impairments in communication. Hyperbaric oxygen therapy (HBOT) might be able to improve each of these problems in autistic individual *(Ohnishi et al., 2000)*.

Specifically, HBOT has been used and can compensate for decreased blood flow by increasing the oxygen content of plasma and body tissues. HBOT has been reported to possess strong anti-inflammatory properties and has been shown to improve immune

function. There is evidence that oxidative stress can be reduced with HBOT through the upregulation of antioxidant enzymes. HBOT can also increase the function and production of mitochondria and improve neurotransmitter abnormalities.In addition, HBOT upregulates enzymes that can help with detoxification problems specifically found in autistic children Impaired production of porphyrins in autistic children might affect the production of heme, and HBOT might help overcome the effects of this problem. HBOT has been shown to mobilize stem cells from the bone marrow to the systemic circulation .Recent studies in humans have shown that stem cells can enter the brain and form new neurons, astrocytes, and microglia .It is expected that amelioration of these underlying pathophysiological problems through the use of HBOT will lead to improvements in autistic symptom *(Rossignol, 2006).*

Studies have demonstrated hypoperfusion to several areas of the autistic brain, most notably the temporal lobes *(Ohnishi et al., 2000).*

Several studies show that reduced blood flow to the temporal regions and other brain areas correlates with many of the clinical findings associated with autism including repetitive, self-stimulatory and stereotypical

behaviors, and impairments in communication, sensory perception, and social interaction *(Boddaert et al., 2004).*

Diminished blood flow to the thalamus has been correlated with the autistic clinical features of repetitive, self-stimulatory, and unusual behaviors including resistance to changes in routine and environment (**Starkstein et al., 2002**) Another study on "high functioning" autistics demonstrated decreased blood flow to areas of the temporal lobe and amygdala, which was correlated with clinical impairments in processing facial expressions and emotions *(Critchley et al., 2000).*

In one study, hypoperfusion of the prefrontal and left temporal areas worsened and became "quite profound" as the age of the autistic child increased . This diminished perfusion correlated with decreased language development .The authors concluded that hypoperfusion "subsequently prevents development of true verbal fluency and development in the temporal and frontal areas associated with speech and communication" *(Wilcox et al., 2002).*

Aim of the Work

The aim of this work is to study the effect of hyperbaric oxygen therapy in autistic Egyptian children.

Autism

Definition:

Autism is a neuro-developmental disorder in the category of pervasive developmental disorders, characterized by problems of social communication, inflexible language and behavior, repetitive sensory-motor movements *(Eigesti et al., 2003; Georgiades et al., 2007).*

Both The Diagnostic and Statistical Manual of Mental Disorders DSM-IV-TR (fourth edition, text revision) **(American psychiatric Association, 2000),** international classification of diseases,10th edition(ICD-10) *(WHO, 1993)* stated that pervasive developmental disorders (PDD)- more often referred today as autism spectrum disorders- include as shown in table (1):

1. Autistic disorder.
2. Asperger's syndrome.
3. Pervasive developmental disorder-not otherwise specified (PDD-NOS) PDD-NOS; also called atypical autism) is diagnosed when the criteria are not met for a more specific disorder *(Volkmar et al., 2009).*
4. Rett's syndrome.
5. Childhood disintegrative disorder.

All these disorders are characterized by varying degrees of impairment in communication skills, social interactions, and restricted, repetitive and stereotyped patterns of behavior *(WHO, 2007).*

Table (1): Types of Pervasive developmental disorders.

Characteristic	Autistic disorder	Asperger's disorder	CDD	Rett's disorder	PDD NOS
Age at onset	< 3 yr	Variable	2–10 yr	5–30 mo	Variable
Presence of regression	Mild, in minority of patients	No	Yes	Yes	No
Gender	M/F ratio 4:1	M>F	M>F	F primarily	M>F
Mental retardation	Present in majority	Absent in majority	Often severe	Often severe	Variable
Social impairment	Yes	Yes	Yes	Yes	Yes
Communication impairment	Yes	No^A	Yes	Yes	Variable
Restricted interests/repetitive behaviors	Yes	Yes	Yes	Yes	Variable

DSM-IV, *Diagnostic and statistical manual of mental disorders*, fourth edition (7); F, female; M, male; M>F, more males than females. ^APragmatic and/or social language may be impaired.

(Amercian Psychiatric Association, 1994)

Regressive autism

A subgroup of children with ASDs experiences a "regression," meaning they stop using the language, play, or social skills they had already learned. This regression usually happens between the first and second birthdays *(Lord et al., 2004).*

Types:

Autism is divided into low-, medium- or high-functioning autism (LFA, MFA, and HFA), based on IQ thresholds *(Baron, 2006).*