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Review Article

Medical & Clinical Research

Autism & Hyperbaric Oxygen Therapy

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OXYMED Case Study

Young DC age 7 - high functioning autism, non-social, non-verbal. Cytokine Testing pre-HBOT.

Cytokine Testing pre-HBOT

OXYMED HEALTH

Date of Birth : 20-Nov-2013
Sex : M
Collected : 16-Jan-2018

Lab id: UR#:

OXYMED, 643 CHAPEL STREET
SOUTH YARRA VIC 3141

INTEGRATIVE MEDICINE

BLOOD - SERUM	Result	Range	Units
CYTOKINES,Extensive Panel			
ProInflammatory Cytokines (TH1)			
Interleukin 1	6.2 *H	0.0 - 2.8	pg/mL
Interleukin 6	6.7	0.0 - 11.0	pg/mL
Interleukin 7	22.7 *H	0.0 - 16.0	pg/mL
Interleukin 8	106.3 *H	0.0 - 28.0	pg/mL
Interleukin 17	26.7 *H	< 13.0	pg/mL
TNFa	21.60 *H	0.00 - 13.00	pg/mL
TNFb	98.0	0.0 - 156.0	pg/mL
S100B	>5000.0 *H	60.0 - 100.0	pg/mL
AntiInflammatory Cytokines (TH2)			
GM-CSF	1217.7 *H	0.0 - 80.0	pg/mL
Interleukin 2	7.3	0.0 - 10.0	pg/mL
Interleukin 3	9.6 *H	< 5.0	pg/mL
Interleukin 4	30.6 *H	0.0 - 19.0	pg/mL
Interleukin 5	5.4	0.0 - 13.0	pg/mL
Interleukin 10	35.3 *H	0.0 - 7.0	pg/mL
Interleukin 12	15.6 *H	0.0 - 14.0	pg/mL
Interleukin 13	24.0 *H	0.0 - 6.0	pg/mL
INFg	18.5	0.0 - 28.0	pg/mL
TGFb	36.4	28.0 - 64.0	pg/mL
Brain Derived Neurotrophic Factor BDNF	47.0	20.0 - 50.0	ng/mL

Cytokine Testing after 70-hours HBOT.

Typically between 50-70 hours of HBOT, there is a "washout" of inflammatory cytokines followed by reduction of the inflammatory marker corresponding with notable elevation of anti-inflammatory cytokines including BDNF (Brain Derived Neurotrophic Factor).

BDNF (Brain Derived Neurotrophic Factor)

OXYMED HEALTH

Date of Birth : 20-Nov-2012
Sex : M
Collected : 26-Feb-2018

Lab id: UR#:

OXYMED, 643 CHAPEL STREET
SOUTH YARRA VIC 3141

INTEGRATIVE MEDICINE

BLOOD - SERUM	Result	Range	Units
Hyperbaric Oxygen Therapy (HBO)	70.0		Hours
CYTOKINES,Extensive Panel			
ProInflammatory Cytokines (TH1)			
Interleukin 1	945.6 *H	0.0 - 2.8	pg/mL
Interleukin 6	<0.4	0.0 - 11.0	pg/mL
Interleukin 7	43.9 *H	0.0 - 16.0	pg/mL
Interleukin 8	>2500.0 *H	0.0 - 28.0	pg/mL
Interleukin 17	16.6 *H	< 13.0	pg/mL
TNFa	213.90 *H	0.00 - 13.00	pg/mL
TNFb	123.0	0.0 - 156.0	pg/mL
S100B	639.0 *H	60.0 - 100.0	pg/mL
AntiInflammatory Cytokines (TH2)			
GM-CSF	1710.3 *H	0.0 - 80.0	pg/mL
Interleukin 2	9.8	0.0 - 10.0	pg/mL
Interleukin 3	1.3	< 5.0	pg/mL
Interleukin 4	34.7 *H	0.0 - 19.0	pg/mL
Interleukin 5	4.7	0.0 - 13.0	pg/mL
Interleukin 10	56.9 *H	0.0 - 7.0	pg/mL
Interleukin 12	18.2 *H	0.0 - 14.0	pg/mL
Interleukin 13	30.0 *H	0.0 - 6.0	pg/mL
INFg	23.1	0.0 - 28.0	pg/mL
TGFb	33.0	28.0 - 64.0	pg/mL
Brain Derived Neurotrophic Factor BDNF	39.0	20.0 - 50.0	ng/mL

Cytokine Testing after 120-hours HBOT (4-months treatment).

OXYMED HEALTH

Date of Birth : 20-Nov-2012
Sex : M
Collected : 16-Apr-2018

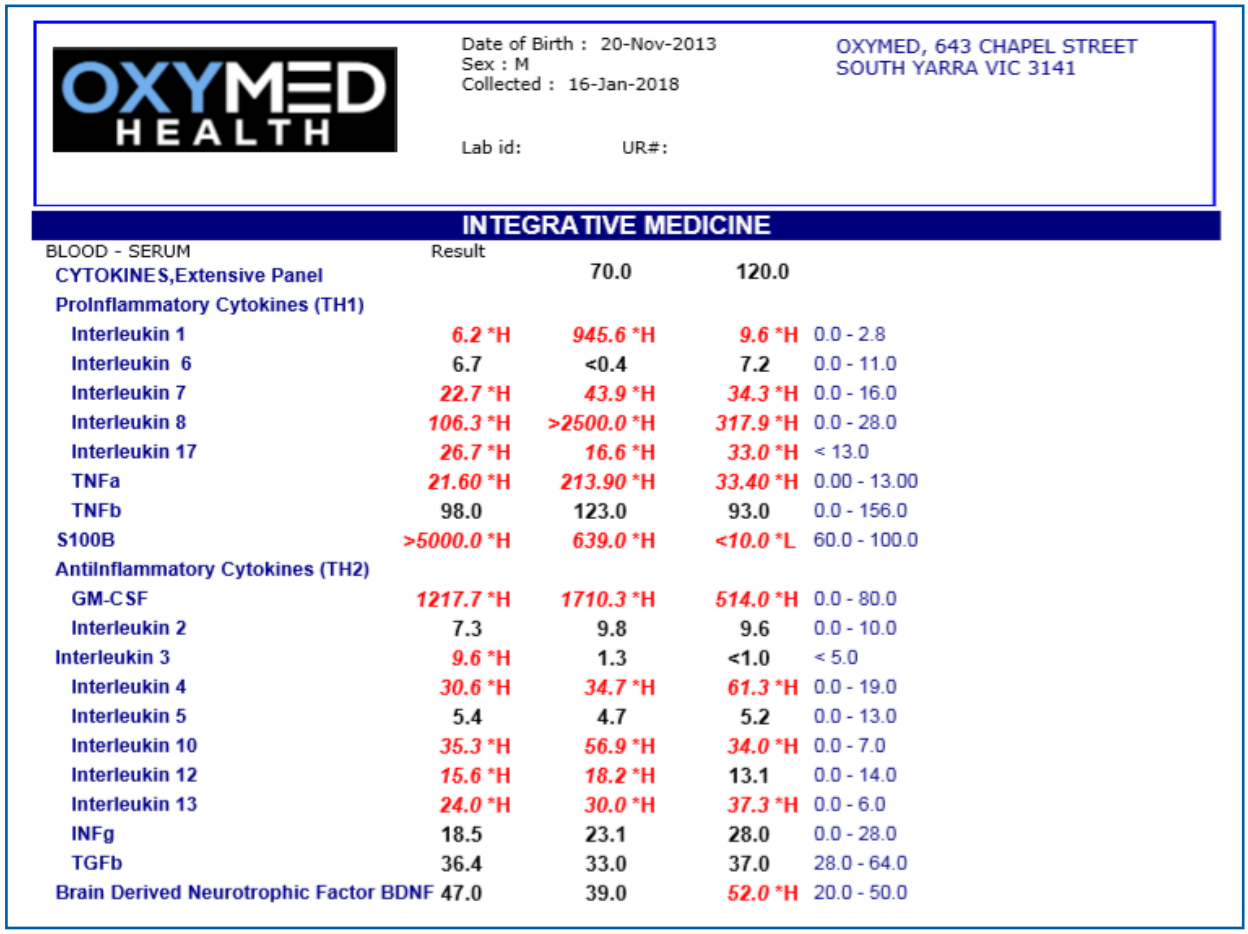
Lab id: UR#:

OXYMED, 643 CHAPEL STREET
SOUTH YARRA VIC 3141

INTEGRATIVE MEDICINE

BLOOD - SERUM	Result	Range	Units
Hyperbaric Oxygen Therapy (HBO)	120.0		Hours
CYTOKINES,Extensive Panel			
ProInflammatory Cytokines (TH1)			
Interleukin 1	9.6 *H	0.0 - 2.8	pg/mL
Interleukin 6	7.2	0.0 - 11.0	pg/mL
Interleukin 7	34.3 *H	0.0 - 16.0	pg/mL
Interleukin 8	317.9 *H	0.0 - 28.0	pg/mL
Interleukin 17	33.0 *H	< 13.0	pg/mL
TNFa	33.40 *H	0.00 - 13.00	pg/mL
TNFb	93.0	0.0 - 156.0	pg/mL
S100B	<10.0 *L	60.0 - 100.0	pg/mL
AntiInflammatory Cytokines (TH2)			
GM-CSF	514.0 *H	0.0 - 80.0	pg/mL
Interleukin 2	9.6	0.0 - 10.0	pg/mL
Interleukin 3	<1.0	< 5.0	pg/mL
Interleukin 4	61.3 *H	0.0 - 19.0	pg/mL
Interleukin 5	5.2	0.0 - 13.0	pg/mL
Interleukin 10	34.0 *H	0.0 - 7.0	pg/mL
Interleukin 12	13.1	0.0 - 14.0	pg/mL
Interleukin 13	37.3 *H	0.0 - 6.0	pg/mL
INFg	28.0	0.0 - 28.0	pg/mL
TGFb	37.0	28.0 - 64.0	pg/mL
Brain Derived Neurotrophic Factor BDNF	52.0 *H	20.0 - 50.0	ng/mL

Cytokine Testing Comparison (4-months treatment)



OXYMED HEALTH

Date of Birth : 20-Nov-2013
Sex : M
Collected : 16-Jan-2018

Lab id: UR#:

OXYMED, 643 CHAPEL STREET
SOUTH YARRA VIC 3141

INTEGRATIVE MEDICINE

BLOOD - SERUM	Result			
CYTOKINES,Extensive Panel		70.0	120.0	
ProInflammatory Cytokines (TH1)				
Interleukin 1	6.2 *H	945.6 *H	9.6 *H	0.0 - 2.8
Interleukin 6	6.7	<0.4	7.2	0.0 - 11.0
Interleukin 7	22.7 *H	43.9 *H	34.3 *H	0.0 - 16.0
Interleukin 8	106.3 *H	>2500.0 *H	317.9 *H	0.0 - 28.0
Interleukin 17	26.7 *H	16.6 *H	33.0 *H	< 13.0
TNFa	21.60 *H	213.90 *H	33.40 *H	0.00 - 13.00
TNFb	98.0	123.0	93.0	0.0 - 156.0
S100B	>5000.0 *H	639.0 *H	<10.0 *L	60.0 - 100.0
AntiInflammatory Cytokines (TH2)				
GM-CSF	1217.7 *H	1710.3 *H	514.0 *H	0.0 - 80.0
Interleukin 2	7.3	9.8	9.6	0.0 - 10.0
Interleukin 3	9.6 *H	1.3	<1.0	< 5.0
Interleukin 4	30.6 *H	34.7 *H	61.3 *H	0.0 - 19.0
Interleukin 5	5.4	4.7	5.2	0.0 - 13.0
Interleukin 10	35.3 *H	56.9 *H	34.0 *H	0.0 - 7.0
Interleukin 12	15.6 *H	18.2 *H	13.1	0.0 - 14.0
Interleukin 13	24.0 *H	30.0 *H	37.3 *H	0.0 - 6.0
INFg	18.5	23.1	28.0	0.0 - 28.0
TGFb	36.4	33.0	37.0	28.0 - 64.0
Brain Derived Neurotrophic Factor BDNF	47.0	39.0	52.0 *H	20.0 - 50.0

Hyperbaric Oxygen Therapy

DC was treated using Hyperbaric Oxygenation Therapy (HBOT) at 1.8ATA and 100% O2 with regular air breaks. DC did not change his medical management. DC changed his diet to an adapted ketogenic diet and supplements focussed on cytokine modulation. DC did not experience any side effects or seizures during or after HBOT sessions. DC's improvement whilst undertaking HBOT was extraordinary. He now attends normal school and continues to improve his daily quality living [1-13].

Autism Spectrum Disorders (ASDs) are characterized by impaired development in social interaction and communication and the presence of a restricted activity and interests. The rising prevalence of ASD has increased the need for evidence-based treatments to lessen the impact of symptoms. It has been suggested that HBOT may alleviate the biochemical dysfunction and clinical symptoms of ASD. Cochrane formed a different viewpoint: 'to date, there is no evidence that hyperbaric oxygen therapy improves core symptoms and associated symptoms of ASD' [3].

Numerous studies of autistic individuals have revealed evidence of cerebral hypo perfusion, neuroinflammation, gastrointestinal inflammation, immune dysregulation, oxidative stress, relative mitochondrial dysfunction, and neurotransmitter abnormalities. For example, cerebral hypo perfusion in autistic children has been correlated with repetitive, self-stimulatory and stereotypical behaviors, and impairments in communication [12-21]. Evidence has identified elevated maternal cytokines during gestation in children with increased risk of ASD [5].

We believe HBOT provides an enormous opportunity to assist both the child and adult with autistic challenges. HBOT increases the net delivery of Oxygenated blood into deprived regions of the brain [1]. HBOT 'revascularizes' regions of inadequate blood flow [2]. HBOT increase both production and circulation of progenitor neural stem cells specific to the individual [16, 17]. HBO activates recoverable idling and dormant neurons in the penumbra zone (where there is diminished tissue Oxygenation) surrounding infarct cells [13-15].

Increased Oxygen delivery into the central nervous systems structures enables the brains ability to better regulate biochemical reactions, mobilizing stem cells supporting autistic recovery (15, 16). HBOT inhibits chronic underlying opportunistic infections including bacteria and viral based infections that have been linked with many neurologic patients and children with autistic disorders. HBOT impacts underlying gut issues and sensitivities associated with ASD [7, 8].

HBOT has been reported to possess strong anti-inflammatory

properties and has been shown to improve immune function. HBOT can overcome the effects of cerebral hypoperfusion by providing more oxygen to the brain and by causing angiogenesis of new blood vessels over time by increasing Vascular Endothelial Growth Factor (VEGF) levels and Brain Derived Neurotrophic Factors (BDNF) [14, 16].

HBOT has been shown to decrease the pro-inflammatory cascade including IL1, IL6, IL7, IL8, TNFa, S100B after an ischemic injury to the brain [9,10 14]. Chronically over expressed pro-inflammatory cytokines can kill cells, but they are also important in mobilizing reparative and regenerative responses. Further, cytokines can affect synaptic strength and synaptic plasticity, and in excess can contribute to maladaptive plasticity, including chronic pain syndromes [4, 9, 10]. HBOT has been shown to increase the counter-inflammatory IL4, IL10 and IL13 levels. HBOT elevates IL10 and Brain Derived Neurotrophic Factor (BDNF) required for neuroplasticity [18].

An Egyptian study reported children treated using HBOT at 1.5 ATA. After 40-hours of HBOT, there was a statistically significant increase in the ratio of regional cerebral blood flow (RCBF) to white matter after HBOT in different brain regions when compared to their levels before HBOT. Benefits reported included: improved language, increased awareness, behavior and socialization by affecting the pathophysiological findings in autism [12].
Rossignol et al, treated children with autism using HBOT at 1.3 atm and 24% oxygen for 40 hourly sessions had significant improvements in overall functioning, receptive language, social interaction, eye contact, and sensory/cognitive awareness compared to children who received slightly pressurized room air [13].

Discussion

The challenge of any intervention is the ability to document the efficacy of treatment. HBOT is not a magic pill but a dosing agent involving two variables; oxygen and pressure. Finding the right dosage and treatment protocol for the individual can be difficult. Cytokine testing pre HBOT and at interval enables a precise outcome measure specific to the individual undertaking HBOT therapy.

Acknowledgement

I would like to thank the parents of DC for permission to use the clinical findings to support this presentation.

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