Autism spectrum disorder (ASD) and hyperbaric Oxygen Therapy

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Background :

The number of people diagnosed with ASD has escalated over the past decade, and prevalence rates continue to increase; 1% of individuals in the United States are reported to have ASD (Gal 2012).
Autistic disorders are defined by a group of disorders characterized by qualitative abnormalities in reciprocal social interactions and communication modalities, as well as a repertoire of interests and activities restricted, stereotyped, and repetitive. These qualitative abnormalities are a pervasive feature of the operation of the subject, in all situations. The syndrome manifests itself in the first 3 years of life and persists into adulthood. At present, the aetiology of ASD is largely unknown, but genetic, environmental, immunological and neurological factors appear to play a role in the development of ASD.
For now, there is no treatment that can cure autism. Support is only symptomatic and requires customized educational therapies. In recent get maximum efficiency when applied at an early stage of disease development

Rationale for HBO use

The hyperbaric oxygen therapy (HOT) could be used for the treatment of autism spectrum disorders (ASD). A number of individuals with ASD have certain physiological abnormalities that HBOT could improve, including cerebral hypo perfusion, inflammation, mitochondrial dysfunction and oxidative stress.

Evidence – Based review of HBO use

Proof of the efficacy of HBOT in ASD is low. Only one randomized controlled study showed the therapeutic benefit but with several bias.

References

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Hyperbaric oxygen in the treatment of childhood autism: a randomised controlled trial.
Sampanthavivat M[1], Singkhwa W, Chaiyakul T, Karoonyawanich S, Ajpru H. Diving Hyperb Med. 2012 Sep;42(3):128-33.

Hyperbaric oxygen treatment in autism spectrum disorders
Daniel A Rossignol, [1] James J Bradstreet,[2,3] Kyle Van Dyke,[4] Cindy Schneider,[5] Stuart H Freedenfeld,[6] Nancy O'Hara,[7] Stephanie Cave,[8] Julie A Buckley,[9] Elizabeth A Mumper,[10] and Richard E Frye

Brief report: **Hyperbaric oxygen** therapy (HBOT) in children with **autism** spectrum **disorder**: a clinical trial. Bent S, Bertoglio K, Ashwood P, Nemeth E, Hendren RL. BMC Pediatrics 2009;9:21.

Controlled evaluation of the effects of **hyperbaric oxygen** therapy on the behavior of 16 children with **autism** spectrum disorders. Jepson B, Granpeesheh D, Tarbox J, Olive ML, Stott C, Braud S, Yoo JH, Wakefield A, Allen MS. J Autism Dev Disord. 2011 May;41(5):575-88. doi: 10.1007/s10803-010-1075-y.

Hyperbaric treatment for children with **autism**: a multicenter, randomized, double-blind, controlled trial.
Rossignol DA, Rossignol LW, Smith S, Schneider C, Logerquist S, Usman A, Neubrander J, Madren EM, Hintz G, Grushkin B, Mumper EA Journal of Autism and Developmental Disorders 2012;42(6):1127–32

Hyperbaric oxygen therapy in **autism**: is there evidence?
Yildiz S, Aktas S, Uzun G. Undersea Hyperb Med. 2008 Nov-Dec;35(6):453-5.

Hyperbaric oxygen therapy in Thai **autistic** children. Chungpaibulpatana J, Sumpatanarax T, Thadakul N, Chantharatreerat C, Konkaew M, Aroonlimsawas J Med Assoc Thai. 2008 Aug;91(8):1232-8.

Conclusion : Recommendation

HBOT should not be recommended for the treatment of ASD to more accurate and favorable results. Type 1 recommendation; Level B evidence

There is interest to continue research with randomized studies with a larger number of inclusion bringing a high level of evidence Type 1 recommendation; Level B evidence

Study (authors, year)	Type	Nb patients	Aim(s) / Evaluation criteria	Inclusion / Exclusion criteria	HBO protocol (pressure, time, nb of session)	Results	Conclusion / comment
Diving Hyperb Med. 2012 Sep;42(3):128-33. Hyperbaric oxygen in the treatment of childhood autism: a randomised controlled trial. Sampanthavivat M1, Singkhwa W, Chaiyakul T, Karoonyawanich S, Ajpru H.		60 children	This study evaluated the efficacy of hyperbaric oxygen therapy (HBOT).	Effects on behaviour were measured using the Autism Treatment Evaluation Checklist score (ATEC) and clinical improvement was measured with the Clinical Global Impression (CGI) system; in particular the clinical change (CGIC) and severity (CGIS) sub-scores.	to receive 20 one-hour sessions of either HBOT at 153 kPa (1.5 ATA) or sham air at 116 kPa (1.15 ATA)	There were no statistically significant differences in average percentage changes of total ATEC score and all subscales scores when comparing the HBOT and sham air groups, either by parents or clinicians. Changes in the CGI scores following intervention were inconsistent between parents and clinicians. For severity scores (CGIS), parents rated their children as more improved following HBOT (P = 0.005), while the clinicians found no significant differences (P = 0.10). On the other hand, for change scores (CGIC) the clinicians indicated greater improvement following HBOT (P = 0.03), but the parents found no such difference (P = 0.28).	no overall clinically significant benefit from HBOT could be shown. Both interventions were safe and well tolerated with minimal side effect from middle ear barotraumas
7. Hyperbaric treatment for children with autism: a multicenter,	We performed a multicenter, randomized, double-blind, controlled trial to assess the efficacy of	62 children	to assess the efficacy of hyperbaric treatment in children with autism. Outcome	children with autism recruited from 6 centers, ages 2-7 years (mean 4.92 +/- 1.21), were randomly assigned	treatments of either hyperbaric treatment at 1.3 atmosphere (atm) and 24% oxygen ("treatment group", n = 33) or slightly	After 40 sessions, mean physician CGI scores significantly improved in the treatment group compared to controls in overall functioning (p =	Children with autism who received hyperbaric treatment at 1.3 atm and 24% oxygen for 40

randomized, double-blind, controlled trial. Rossignol DA, Rossignol LW, Smith S, Schneider C, Logerquist S, Usman A, Neubrander J, Madren EM, Hintz G, Grushkin B, Mumper EA	hyperbaric treatment in children with autism.		measures included Clinical Global Impression (CGI) scale, Aberrant Behavior Checklist (ABC), and Autism Treatment Evaluation Checklist (ATEC).	to 40 hourly treatments of either hyperbaric treatment	pressurized room air at 1.03 atm and 21% oxygen ("control group", n = 29).	0.0008), receptive language ($p < 0.0001$), social interaction ($p = 0.0473$), and eye contact ($p = 0.0102$); 9/30 children (30%) in the treatment group were rated as "very much improved" or "much improved" compared to 2/26 (8%) of controls ($p = 0.0471$); 24/30 (80%) in the treatment group improved compared to 10/26 (38%) of controls ($p = 0.0024$). Mean parental CGI scores significantly improved in the treatment group compared to controls in overall functioning ($p = 0.0336$), receptive language ($p = 0.0168$), and eye contact ($p = 0.0322$). On the ABC, significant improvements were observed in the treatment group in total score, irritability, stereotypy, hyperactivity, and speech ($p < 0.03$ for each), but not in the control group. In the treatment group compared to the control group, mean changes on the ABC total score and subscales were similar except a greater number of children improved in irritability	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.

						(p = 0.0311). On the ATEC, sensory/cognitive awareness significantly improved (p = 0.0367) in the treatment group compared to the control group. Post-hoc analysis indicated that children over age 5 and children with lower initial autism severity had the most robust improvements. Hyperbaric treatment was safe and well-tolerated	
J Autism Dev Disord. 2011 May;41(5):575-88. doi: 10.1007/s10803-010-1075-y. Controlled evaluation of the effects of hyperbaric oxygen therapy on the behavior of 16 children with autism spectrum disorders. Jepson B1, Granpeesheh D, Tarbox J, Olive ML, Stott C, Braud S, Yoo JH, Wakefield A, Allen MS.	Controlled evaluation of the effects of hyperbaric oxygen therapy on autism spectrum disorders.	16 children	Five applications of multiple baselines were completed across participants with autism spectrum disorders	Five applications of multiple baselines were completed across 16 participants with autism spectrum disorders	The current study examined the effects of 40 HBOT sessions at 24% oxygen at 1.3 ATA on 11 topographies of directly observed behavio		No consistent effects were observed across any group or within any individual participant, demonstrating that HBOT was not an effective treatment for the participants in this study.

J Autism Dev Disord. 2012 Jun;42(6):1127-32. doi: 10.1007/s10803-011-1337-3. Brief report: Hyperbaric oxygen therapy (HBOT) in children with autism spectrum disorder: a clinical trial. Bent S1, Bertoglio K, Ashwood P, Nemeth E, Hendren RL.	to determine whether HBOT leads to parental reported behavioral changes and alterations in cytokines in children with ASD	10 children		Ten children completed 80 sessions of HBOT and all improved by 2 points on the clinician-rated CGI-I scale (much improved) as well as several parent-completed measures of behavior	completed 80 sessions of HBOT	The lack of a control group limits the ability to determine if improvements were related to HBOT. Enrolled children did not exhibit abnormal cytokine levels at baseline and no significant changes in mean cytokine levels were observed	Although this study was limited by the small sample size and by the variable nature of cytokines, we found no evidence that HBOT affects cytokine levels or that cytokine levels were associated with behavioral changes