Hospices Civils de Lyon

votre santé,
notre engagement

OHB ET INDICATIONS NEUROLOGIQUES

(HORS EG ET PATHOLOGIES POST RADIQUES)

DIPLOME D'ETUDE SUPERIEURE INTER UNIVERSITAIRE

DIPLÔME INTER UNIVERSITAIRE

DE MEDECINE HYPERBARE & DE MEDECINE DE PLONGEE

AIX MARSEILLE UNIVERSITE
LYON UNIVERSITÉ

Dr Thierry Joffre (HCL)

Indications Cliniques de l'OHB

HAS Janvier 2007 – ECHM Avril 2016

CMH LYON
File active
« stroke »

2014 : 0
2015: 1 patient
2016: 0
2017: 0
2018 : 0
2019: 0

1 patient en 2015:
AVC ischémique aigu sylvien
6 séances ATA 2,5 sans récupération,
Puis stop devant OAP

Table 2
Recommendations on the indications accepted for HBOT (there was no Level A evidence)

Condition	Level of evidence B	Level of evidence C	Agreement level
Type 1			
CO poisoning	X		Strong agreement
Open fractures with crush injury	X		Strong agreement
Prevention of osteoradionecrosis after dental extraction	X		Strong agreement
Osteoradionecrosis (mandible)	X		Strong agreement
Soft tissue radionecrosis (cystitis, proctitis)	X		Strong agreement
Decompression illness		X	Strong agreement
Gas embolism		X	Strong agreement
Anaerobic or mixed bacterial infections		X	Strong agreement
Sudden deafness	X		Strong agreement
Type 2			
Diabetic foot lesions	X		Strong agreement
Femoral head necrosis	X		Strong agreement
Compromised skin grafts and musculo-cutaneous flaps		X	Strong agreement
Central retinal artery occlusion (CRAO)		X	Strong agreement
Crush Injury without fracture		X	Agreement
Osteoradionecrosis (bones other than mandible)		X	Agreement
Radio-induced lesions of soft tissues (other than cystitis and proctitis)		X	Agreement
Surgery and implant in irradiated tissue (preventive treatment)		X	Agreement
Ischaemic ulcers		X	Agreement
Refractory chronic osteomyelitis		X	Agreement
Burns, 2nd degree more than 20% BSA		X	Agreement
Pneumatosis cystoides intestinalis		X	Agreement
Neuroblastoma, stage IV		X	Agreement
Type 3			
Brain injury (acute and chronic TBI, chronic stroke, post anoxic encephalopathy) in highly selected patients		X	Agreement
Radio-induced lesions of larynx		X	Agreement
Radio-induced lesions of the CNS		X	Agreement
Post-vascular procedure reperfusion syndrome		X	Agreement
Limb replantation		X	Agreement
Selected non-healing wounds secondary to systemic processes		X	Agreement
Sickle cell disease		X	Agreement
Interstitial cystitis		X	Agreement

ndications Cliniques de l'OHB

Ce qui n'est plus recommandé depuis 2017

Table 3
Recommendations on the non-accepted indications for HBOT; all have only Level D evidence

Condition	Level of evidence D	Agreement
Post sternotomy mediastinitis	X	Agreement
Malignant otitis externa	X	Agreement
Acute myocardial infarction	X	Agreement
Retinitis pigmentosa	X	Agreement
Facial (Bell's) palsy	X	Agreement

Table 4
Recommendations on those indications for which HBOT should not be used; no Level A evidence

Condition	Level of evidence A	B	C	Agreement
Autism spectrum disorders		X		Agreement
Placental insufficiency			X	Agreement
Multiple sclerosis		X		Agreement
Cerebral palsy		X		Agreement
Tinnitus		X		Agreement
Acute phase of stroke			X	Agreement

L’ AVC en France

- **150 000 AVC annuels**
  - 25 % de guérison sans séquelle
  - 25 % de décès

- **Physiopathologie:**

La rupture ou la thrombose vasculaire induit une hypo perfusion et hypoxie tissulaire d’aval à l’origine de 2 types de lésions:

- Une **lésion centrale nécrotique** non fonctionnelle et non viable
- Une couronne périphérique (« **zone de pénombre ischémique** ») viable mais non fonctionnelle (non excitable électriquement pour les neurones). Cette zone de pénombre, siège d’une hypoxie chronique, est le siège de dysfonctionnements métaboliques:
  - Altération de la production d’énergie cellulaire par les mitochondries
  - Arrêt des mécanismes de biosynthèses cellulaires
  - Présence importante de radicaux libres oxygénés
  - Présence importante de glutamate (cytotoxique)
- Cette zone de pénombre peut subsister pendant plusieurs années avant d’aboutir à une apoptose cellulaire

OHB et AVC séquellaire

OPEN ACCESS Freely available online

PLOS | ONE

Hyperbaric Oxygen Induces Late Neuroplasticity in Post Stroke Patients - Randomized, Prospective Trial

Shai Efrati[1,2,3]*, Gregori Fishlev[1], Yair Bechor[1], Olga Volkov[3,4], Jacob Bergan[1], Kostantin Kliakhandler[5], Izhak Kamiager[3,6], Nachum Gal[1], Mony Friedman[1], Eshel Ben-Jacob[2,5,7], Haim Golan[3,4]

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Abstract

Background: Recovery after stroke correlates with non-active (stunned) brain regions, which may persist for years. The current study aimed to evaluate whether increasing the level of dissolved oxygen by Hyperbaric Oxygen Therapy (HBOT) could activate neuroplasticity in patients with chronic neurologic deficiencies due to stroke.

Methods and Findings: A prospective, randomized, controlled trial including 74 patients (15 were excluded). All participants suffered a stroke 6–36 months prior to inclusion and had at least one motor dysfunction. After inclusion, patients were randomly assigned to "treated" or "cross" groups. Brain activity was assessed by SPECT imaging; neurologic functions were evaluated by NIHSS, ADL, and life quality. Patients in the treated group were evaluated twice: at baseline and after 40 HBOT sessions. Patients in the cross group were evaluated three times: at baseline, after a 2-month control period of no treatment, and after subsequent 2-months of 40 HBOT sessions. HBOT protocol: Two months of 40 sessions (5 days/week), 90 minutes each, 100% oxygen at 2 ATA. We found that the neurological functions and life quality of all patients in both groups were significantly improved following the HBOT sessions while no improvement was found during the control period of the patients in the cross group. Results of SPECT imaging were well correlated with clinical improvement. Elevated brain activity was detected mostly in regions of live cells (as confirmed by CT) with low activity (based on SPECT) – regions of noticeable discrepancy between anatomy and physiology.

Conclusions: The results indicate that HBOT can lead to significant neurological improvements in post stroke patients even at chronic late stages. The observed clinical improvements imply that neuroplasticity can still be activated long after damage onset in regions where there is a brain SPECT/CT (anatomy/physiology) mismatch.

Trial Registration: ClinicalTrials.gov NCT00715897

2012

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2012

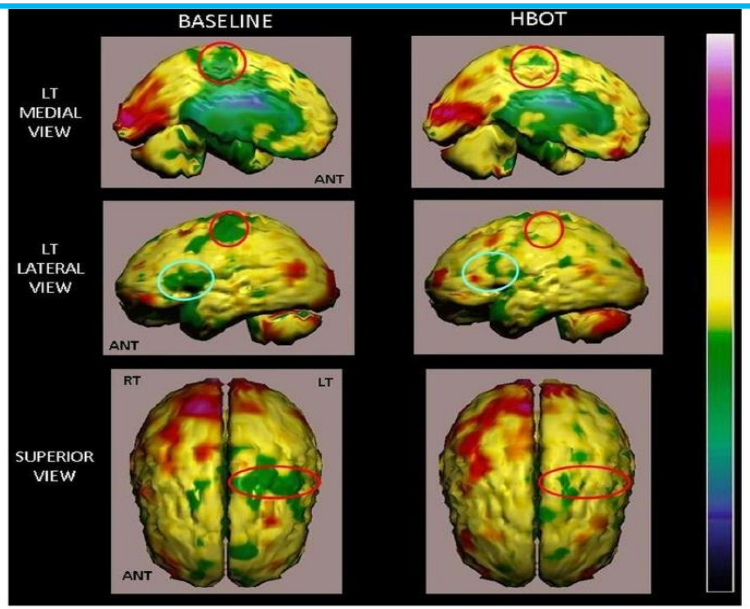

Figure 5. Volume rendered Brain SPECT perfusion maps of Example 2. The results are of a patient in the treated group, suffering from right hemiparesis due to ischemic stroke that occurred 14 months prior to her inclusion in the study. Comparison of pre- and post-hyperbaric treatment SPECT scans. These SPECT images demonstrate significant improvement of perfusion deficits in the left hemisphere involving the medial and posterolateral frontal area (motor cortex, red circles) and lateral inferior frontal region (Broca's area, blue circles) in comparison to the baseline SPECT. HBOT SPECT findings correlate positively with the patient's improved motor and verbal functions.
doi:10.1371/journal.pone.0053716.g005

Table 2. Summary of the results of the National Institutes of Health Stroke Scale (NIHSS), activities of daily living (ADL) and quality of life questionnaire (EQ-5D and EQ-VAS).

	Treatment group				Cross group				
	Baseline	Post HBOT	P_1	P_2	Baseline	Control period	Post HBOT	P_1	P_3
NIHSS	8.53±3.62	5.52±3.59	<0.0001	0.004	8.71±4.11	8.34±4.25	5.85±3.44	0.43	<0.0001
ADL	16.1±6.52	12.77±7.26	<0.0001	0.02	17.38±9.49	17.45±9.53	13.82±8.75	0.42	<0.0001
EQ-5D	9.3±1.36	7.67±1.33	<0.0001	0.009	8.78±1.55	8.64±1.69	7.57±1.51	0.122	<0.0001
EQ-VAS	4.93±1.62	6.45±1.50	<0.0001	0.016	5.14±2.25	5.34±2.27	6.79±1.85	0.053	<0.0001

*Data presented as Mean ± standard deviation.

Abbreviations: NIHSS = National Institutes of Health Stroke Scale; ADL = activities of daily living; EQ = Evaluation of Quality of life evaluation by the EQ-5D descriptive system and the EQ visual analogue scale (EQ-VAS). HBOT = Hyperbaric Oxygen Therapy.

P_1 = p value compared to baseline in the same group. P_2 = p value compared to the cross group after the control period. P_3 = p valus compared to the 2nd evaluation at the end of the control period.

doi:10.1371/journal.pone.0053716.t002

OHB et AVC séquellaire

2017 – CMH NICE – Dr Bernard GAMAIN
Protocole OHB AVC

- Étude rétrospective,monocentrique sur 9 cas :janvier 2014 à Septembre 2016 (actuellement en 2017: 25 patients ont été traités ou en cours de traitement)
- sujets de plus de 18 ans
- AVC ischémique ou hémorragique-critères de l'OMS (1)

  (diagnostiqué par neurologue-confirmé par imagerie)
- AVC avec déficience motrice entre 6 mois et 3 ans post-lésion
- 4O séances d'OHB 2,5 ATA-90 mn 5 jours sur 7

OHB et AVC séquellaire

2017 – CMH NICE – Dr Bernard GAMAIN
Protocole OHB AVC

A plus de six mois d'un AVC on ne note habituellement plus d 'amélioration significative fonctionnelle malgré la prise en charge rééducative (5).

Il n'y a plus d'amélioration de l'activité de marche après cette période (11,12)

Cette **étude rétrospective** met en évidence que l'utilisation de l'OHB en phase séquellaire entraine :

-**une amélioration significative de l'activité de marche** documentée par:

- le périmètre au test de six minutes de marche
- sur la vitesse de marche

-**une amélioration non significative sur l'analyse du nombre de marches en montée et descente**

Conclusion

- **L'indication d'un traitement hyperbare pour des séquelles d'AVC reste optionnelle avec un niveau de preuve faible (consensus d'experts) en Evidence Based Medicin**

- **Les patients ne sont pas tous éligibles. En dehors des contre-indication de l'OHB, Une imagerie fonctionnelle métabolique (tomoscintigraphie par émission photonique ou SPECT) en faveur d'une zone de pénombre ischémique est nécessaire.**

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