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CENTRAL RETINAL ARTERY OCCLUSION

Rational of the application of Hyperbaric Oxygenation

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1. BACKGROUND - INTRODUCTION

The Retina is the most critically oxygen-sensitive tissue of the human body. Any complete ischemic-hypoxic injury produces an immediate loss of visual function. Main causes are embolism or thrombosis of the Central Retinal Artery or of their branches. Much more Embolism than thrombosis, sometimes associated to previous general disorders[1-20], or as iatrogenic result of some interventions[21-37].

Central Retinal Artery Occlusion (**CRAO**) is a non a frequent event that currently remains as an unresolved health problem. Any case implies a serious deterioration of the quality of life of the patient, and of his/her family, as well as an important social problem for the national security system, on the base of permanent neediness of special health assistance for the whole rest of the patient's life. Several instrumental interventions[38-42] have been tried as well as many aggressive drug therapies, with especial attention to thrombolysis[43-59], but no one is considered as a valid alternative[60-3].

Physical and drug agents try to vasodilate the retinal vessels as a palliative alternative to mobilize the embolus to a less critical area, but even in the most successful event the results are always poor. Retinal arteries do not have muscular lane, thus vasodilating drugs cannot experience a positive effect in cases of CRAO but they will develop instead the classic phenomena of arterial robbing. In spite of that, vasodilators have been used many times.

Mild vasodilation of retinal vessels can be produced by Carbogen, a synthetic mixture of Oxygen and Carbon dioxide, and it was slightly useful in some few selected cases[64-65].

Rheological drugs like fraxiparine[66], Verapamil[67], urokinase[68], bolus of steroids[56-7,69,70], bifemelane[71], pentoxifylline[72], E1-Prostaglandin[73], tissue activator Plasminogen[74-7], Nitroglycerine[78], and others have been tried but no one has proved any definitive beneficial effect.

As mentioned above, an spontaneous recovery of a CRAO shall not be expected, so any treatment of any kind that shows a recovery, even partial, in the outcome of these patients will ever be a favourable therapeutical resource.

2. RATIONALE FOR HBO USE

Spontaneous reperfusion of the Central Retinal Artery always happens but with a different delay depending on individual factors[79,80]. The great majority of Retina's consulted specialists agreed that in the majority of cases the reperfusion appears between the 14 and 18 days. The general assessment is that repermeabilization will be achieved in all cases at three weeks after the occlusion. However, at this moment, even with an early recanalization, the retinal cells will be seriously damaged and no possibility of visual recovery exists.

Different studies and opinions estimated very different hypoxic limits conditioning the visual outcome in case of CRAO[80-1]. The most common assumption is that the retina will be definitive lost few hours after the occlusion.

Obviously, if retinal necrosis happens no therapy can be effective; this is out of discussion. However, it must be reminded that, in spite of the fact that the retina's main blood supply is given through its Central Artery, about 10-15% of the perfusion of the external lanes is provided by choroidal circulation, and some individuals have developed an ancillary blood supply through the chorioretinal arteries[82-3]. In such conditions, some silent retinal cells can remain in hypoxic ischemic penumbra[84]. However, this alternative oxygen deliver is poor and insufficient by itself alone to definitively maintain retina in rather good conditions, and this will be only a partial help capable to simply delay a final visual bad outcome. Depending on the combined effect of *Dalton* and *Henry*'s laws, that is to say being undoubtly warranted by basic physical and chemical principles, Hyperbaric Oxygenation (HBO) enhances plasmatic oxygen delivery and increases up to 23 times the availability of free oxygen remaining dissolved in the plasma thus not linked to haemoglobin[85-8]. In such conditions HBO will increase the plasmatic oxygen transport that will access to the retina through choroidal circulation, feeding to the hypoxically injured but still not necrotic cells in order to maintain the retina in rather good conditions until the moment that a valid spontaneous reperfusion will be achieved[89-92].

Plasmatic oxygenation, or in other words, life conditions without oxygen linked to haemoglobin, has proved to be greatly effective[93] in different situations of hypoxia, caused by a deficit of microcapilarity perfusion, or metabolic impairment to obtain oxygen from erythrocytes, or blockage of tissues interchange caused by poisons or toxics, or rheological disorders in which erythrocytes can not deliver oxygen to the cell.

Consequently, HBO can be a promising valid therapy for patients suffering from an acute loss of vision due to an occlusion of the Retinal Central Artery as the best way, if any other exists, of enhancing oxygen delivery to the Retina in spite of the fact that its Central artery has been occluded.

3. EVIDENCE – BASED REVIEW OF HBO USE

The circulatory effects of oxygen breathed at high absolute pressure are known from the first half of the XXth Century[94]. Since the sixties, some reports suggested a positive effect of HBO in the treatment of acute retinal circulatory disorders[95-150].

This report is focussed on the most important of them, the CRAO, but the majority of the conclusions could be applied to occlusions of the Branch retinal arteries[151-5] or of the central venous too[156-69].

Literature Search Method. CRIS-UTH created in 1988 a documental data base oriented to Diving and Hyperbaric Medicine, using the most adequate software at the moment what have been changed several times the in following years. Since then, this database has been grown with the monthly download of new references included in MEDLINE/Pub Med, Excerpta Medica/EMED, and periodical incorporation of references and abstracts obtained from the Proceedings books of the annual meetings of the UHMS, EUBS, MEDSUBHYP, and of the ICHM which is held every three years. The current CRIS-UTH's documental database currently includes almost all existing papers related to Diving and Hyperbaric Medicine whose current number of references was higher than 30,000 in February 2016. Additionally, up to the 31 December 2015 the PubMed Data base recovers more than 2000 articles related to CRAO published after 1980. Once filtered as Major Headings, being cross references and duplicities eliminated, the final number of papers really related to CRAO was 767. Seven of these papers have indexed as a major topic the therapy with Hyperbaric Oxygenation. Only 267 of these

articles having been published since 2010, and among them only 3 were related to HBO therapy. However, refiltering these references, entering into detail of their content, and merging them with edited proceedings books of International Conferences on Hyperbaric Medicine, the actual number of articles mainly related to HBO and CRAO was 83. An analysis of these references defines a number of about 700 CRAO patients suffering from a CRAO that have received HBO in almost all European countries as well as in China, the old Sovietic Republics, Japan, and the USA. No of these papers reported neither double blind nor randomized studies.

The Table 1 contains a summary of 17 papers that reported series of CRAO patients treated with HBO. It has been modified by the author of this chapter departing from the Tables 1.1 and 1.2 included by H. Murphy-Lavoie in the INDICATIONS Book of the Undersea & Hyperbaric Medical Society (UHMS).

Society[170] (UHMS, 2014) for the exclusive use in the ECHM's Consensus Conference on Hyperbaric Medicine, Lille, France, 2016

Only reports of a minimum of 8 cases have been considered for our review. Other reports are included in the references as case presentations. The main attention of the present report has been given to cases of occlusion of the Central artery of the retina. However, some of the analyzed references included combination of patients suffering a CRAO and/or a Branch Arterial Retinal Occlusion (BRAO). Reports of minor series of patients suffering exclusively from either BRAO or retinal vein occlusion, have been excluded, but they are cited too in the References section.

No of these reports contains randomized controlled studies. From a strict analytical methodology, the evidence level of these data is low. However, from a clinical point of view it contains a large series of patients with a satisfactory outcome that have been obtained in the treatment of a very seriously handicapping disease of which no valid rational therapy exists at the present days. The 62.35% of these 672 cases have obtained a significant improvement of their visual function. It is obvious that many methodological defects exist, but these data must not be neglected since it gives a solid base to continue working in this way after having designed a valid protocol to be followed by hyperbaric centres of all Europe whose results should be incorporated into a common Central Register.

4. PATIENTS SELECTION FOR HBO

Some of the analyzed articles communicated favourable results in application of HBO to patients that have suffered a CRAO several days before. These observations are in contrast with the frequent conviction that any possible therapy in case of CRAO must be applied within the first hours after the onset of the occlusion[62]. On the contrary, this observation is consequent with the therapeutical hypothesis that HBO can awake retinal cells that remained in ischaemic penumbra waiting for the recanalization of the central artery that will occur in the following days or weeks. Other interesting observations reported that the recovery of the visual function does not ever happen after the first hours or days of treatment, but the patients recover their visual function sometimes after 10-15 days of HBO therapy[149.] These observations are again coherent with the HBO's therapeutical hypothesis. For these reasons, our recommendation is to accept CRAO patients candidate to HBO at least until 21 days after occlusion, based on the estimated time needed for a complete repermeabilization or recanalization.

Inclusion criteria. Patients of any age and gender being diagnosed as suffering from a CRAO by an ophthalmologist during the 21st days before. It should be highly recommended to send the patients to the Hyperbaric Centre as soon as possible, and the ideal figure is to start HBO in the first hours or minutes after the sudden lost of vision. However, patients received without highest delay, up to 21 days, must not be rejected.

Table 1.-TREATMENT OF RETINAL ARTERY OCCLUSIONS

Summary of the analysis of clinical reports in the period 1965-2015

Study	CRAO BRAO	Patients (n=)	HBO (ATA)	Additional treatments	Delay to HBO	Patients improving	%	Comments
Takahashi et al. 1977 [109]	Not specified	9	2.3	Ocular massage, paracentesis, vasodilator, stellate ganglion block	1–6 days	9	*100,0*	CRAO or Branch not specified. Stellate ganglion block
Sasaki et al. 1978 [110]	CRAO	21	n.s.	Stellate ganglion block	n.s.	13	*61,9*	HBO+stellate ganglion block
Krasnov et al. 1981 [112]	CRAO	39	n.s.		n.s.	22	*56,4*	All-Union Research Institute of Eye Diseases of Moscow
Zhang & Cao 1986 [115]	CRAO	80	n.s.		n.s.	49	*61,3*	
Desola et al. 1986 [114]	CRAO	20	2.3	HBO / 12 or 24h 7 days a week	1-15 days	11	*55,0*	Preliminary report of a non randomized prospective study. No difference HBO / 12 or 24h.
Miyake et al. 1987 [116]	CRAO (53) BRAO (19)	72	2.3	2% carbocaine vasodilators, stellate ganglion block	18 hours to 15 days, all but 3 within 12 days	32	*44,4*	Mixed Central artery and branches
Kindwall & Goldmann 1988 [118]	CRAO	14	n.s.		n.s.	7	*50,0*	
Hirayama et al. 1990 [71]	CRAO	17	n.s.	Urokinase, steroid, bifemelane HCL	<1 month	12	*70,6*	
Hertzog et al. 1992 [124]	CRAO	19	1.5 - 2.0	Timolol, maleate 0.5%, steroids, carbogen, acetazolamide, retrobulbar anesthesia, vasodilator, ocular massage, paracentesis,	1: <8 h. 2: 8-24h. 3: >24h. 4: All patients	14	*73,7*	Many medical therapies. Favourable results when HBO applied within 8h
Yotsukura et al. 1993 [127]	CRAO	15	n.s.	ocular massage, urokinasse i.v., prostaglandin i.v.	3 h. - 6 days	8	*53,3*	Additional drug treatment
Aisenbrey et al. 2000 [135]	CRAO (8) BRAO (10)	18	2.4	Ocular massage, paracentesis, vasodilator, stellate ganglion block, acetazolamide i.v.	n.s.	12	*66,7*	Mixed Central artery and branches
Beiran et al. 2001 [136]	CRAO (29)	35	2.8	Ocular masage, retrobulbar block, timolol, acetazolamide, paracentesis	<8 h.	29	*82,9*	Definitive results of 1993 paper
Weinberger et al. 2002 [138]	CRAO	21	n.s.	ocular massage, hemodilution, antiglaucoma eye drops	4-12 h.	13	*61,9*	Many additional medical treatments. Only short onset.
Murphy-Lavoie et al. 2004 [140]	CRAO + BRAO	16	2.0		6 h.- 4 days	12	*75,0*	Mixed CRAO and BRANCH. Preliminary data. Short term.
Cope et al.2011 [81]	CRAO	11	2.4		5-144 h.	8	*72,7*	Up to six days
Menzel et al. 2012 [147]	CRAO	51	2.4	Hemodilution	<12 h.	30	*58,8*	Retrospective, non-randomized, comparative study
Desola et al. 2015 [149]	CRAO	214	2.3	20 sessions 1 x day 7 days/week	2.83 ± 6.35 (1-65) days	138	*64,5*	Large serie. Preliminary results of 1987 included. Prospective non randomized study. Favourable results in delayed treatments.
	n = 672 cases				Improved :	419	62,4 %	

REQUIREMENTS FOR ANALYSIS INCLUSION : Series of mimimum 8 cases. Minor series, only-Branch arteries, or Vein occlusions are excluded but cited in References as case presentations.

Modified by the author specifically for this report from the H.Murphy-Lavoie's original Table 1 of the Chapter 2A. Indications Book. Undersea & Hyperbaric Medical Society (UHMS) [170]
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Exclusion criteria.

1. Those presenting absolute contraindications for HBO therapy.
2. Heavy smokers who do not accept the compromise of stop smoking at least during the days of HBO therapy. These restriction is based on the conviction that trying to enhance oxygen supply while maintaining at the same time a vasocontricting agent, as well as trying to enhance oxygen blood oxygen concentration while applying simultaneously a powerful oxygen-consuming and carboxyhaemoglobin-producer drug, would be an absolutely non sense procedure.
3. Other drug addictions or consumption of substances presumptively antagonists of good oxygenation.

Mandatory previous ophthalmologic explorations. Without exclusion of other optional tests, upon ophthalmologist's criterion, at least the following explorations will be essentially required, ideally before of application of the first HBO session.

1. ETDRS scale Best Corrected Visual Acuity (BCVA)
2. Colour Fundus Photography
3. Optical Coherence Tomography Exam of the macular area and the optic nerve.
4. Multifocal Electroretinogram
5. Visual Field Test
6. Fundus Autofluorescence imaging

In cases of absolute impossibility of that, in order of not to delay the HBO treatment in urgency, Best Corrected Visual Acuity and Colour Fundus Photography must be performed at reception, and the other tests will be performed in the next 48 hours.

The same explorations must be repeated at the end of the HBO therapy in order to establish valid comparisons.

5. CURRENT SUGGESTED PROTOCOL

HBO therapy shall be started as soon as possible upon reception of the patient.

Absolute pressure of the chamber. There is no definitive agreement on the better pressure for HBO in these patients. A general concern exists in relation to the hyperoxic vasoconstriction, for which reason some authors in the past applied stellate ganglion block procedures to compensate the reduction on the blood flow[109,110,115].

However, the research made in 1965 by Saltzman et al[171] must be reminded. Funduscopies were performed to healthy volonters inside the chamber at pressures between 2.5 and 3.6 ATA assessing that important vasoconstriction was ever observed. However it was noted as well that even with the highest vasoconstriction, the oxygen output range was very high and all retinal vessels appeared greatly hyperoxigenated. For those reasons, it shall be recommended to apply HBO at not less than 2.0 ATA but not more than 2.5 ATA.

Duration of HBO sessions. There is no definitive principle to establish the ideal duration of an HBO session for CRAO. It seems rational to provide at least 60 minutes at the maximal pressure breathing oxygen, with exclusion of the compression and decompression phases, and air breaks if done. The total time remaining the patient inside the chamber will be about 90 minutes.

Sequence of sessions. One HBO session daily, seven days a week, with a time interval never greater than 24 hours. Being CRAO a seriously hypoxic disorder, it would be out of any rational to interrupt therapy on Saturday or Sunday. A comparative not randomized analyses did not find significant difference between patients that received one HBO session once a day and those receiving two sessions daily[149.]

Total period of HBO. As a direct consequence of the criteria above and of the therapeutical hypothesis of HBO, the treatment must be maintained during 21 days, unless any of the interruption criteria appeared. It must be reminded again, that the recovery of vision shall not be expected after the first sessions because it usually happens after more than 10 days of therapy.

Interruption criteria. The HBO therapy shall be interrupted in the following possible events.

1. Detection of serious secondary effects directly related to HBO. The development of a tympanic barotrauma does not necessary constitute a criterion for exclusion.
2. Serious deterioration of the general condition of the eye as objectively signalled by the primary ophthalmologist
3. Patients repeatedly non-adherent to the guidelines, protocols and medical recommendations.
4. Complete subjective recovery of the visual function and objectively validated by the primary ophthalmologist.

Validation of results. The Outcome of the patients after Hyperbaric Oxygenation should be validated in 6 levels according to the following criteria.

1. HEALING. Complete recovery of the visual function.
2. IMPORTANT IMPROVEMENT. Amelioration of 3 Lines or more in the BCVA.
3. MILD IMPROVEMENT. Amelioration of 1 or 2 lines in the BCVA.
4. MINIMAL IMPROVEMENT. Passing from full darkness to light perception or fingers counting.
5. NO CHANGE. The patients remain subjectively and objectively equal as when HBO was started, but without deterioration of the general eye's condition..
6. WORSENING. Clear deterioration of the general status of the eye as objectively estimated by the ophthalmologists compared when HBO therapy was started.

Procedure. The results of any case shall be included in a central database. Statistical analysis should be done. Results will be communicated independently of their kind. Spreading unsatisfactory results among the hyperbaric community is as useful and necessary as sharing the satisfaction of good results.

Creation of an European Central Registry. Bearing in mind the -fortunately- low prevalence of this serious disorder, no medical centre alone in the whole world would be capable to produce only by themself a valid and reliable controlled study. There is a strong basis for an international multicentre study under the scope of International Societies of both Ophthalmology and Hyperbaric Medicine based on the recovery of visual function from patients being treated with HBO following all the same protocol. As a spontaneous recovery shall not be expected, no random or placebo control group is needed. Only ophthalmologic controls are essential. It would be relatively easy because patients will never be in critical conditions of their general status, so sophisticated measures will not be needed and HBO treatment will not be difficult.

6. CONTROVERSIAL OBSERVATIONS

Different opinions come from different areas and different countries. Some of them are possibly based on misunderstandings or a confusion of basic concepts. Some comments follow in relation to the main controversial topics.

DO NOT EXPECT A SPONTANEOUS RECOVERY OF VISION. Some exceptional cases have been communicated[50,80] conditioned to unfrequent personal alternative vascular conditions. In the daily clinical practice, the common opinion of the wide majority of ophthalmologists is that a recovery of vision after a CRAO shall not be expected, and even in the unfrequent case of an alternative cilioretinal artery persistence, the improvement capacity of vision recovery would be

mild and incomplete. Consequently HBO shall not be delayed for that reason, and the inclusion criteria must not be affected for such an infrequent possibility.

AVOID NORMOBARIC OXYGEN IN CRAO PATIENTS. Is generally ignored by the medical non specialized community that oxygen, either normobaric or hyperbaric, is a powerful vasoconstrictive agent. Administration of normobaric oxygen to CRAO patients is not recommended. HBO produces an important vasoconstriction but the great hyperoxic oxygen delivery always compensates a favourable oxygen output, as it was clearly demonstrated in the above mentioned experience of Saltzman[171] in 1965. Normobaric oxygen, instead, causes as well an important vasoconstriction but it is not compensated with so high increase of oxygen content, even in the infrequent event of being administered by means a very high concentration delivery system, thus the tissue distribution can be low.

INADEQUATE VALIDATION OF RESULTS AFTER THE FIRST SESSIONS. Another widely diffused protocol has been suggested by other authors[148,170] in which the sequence, the duration and the periodicity of the HBO treatment is completely dependent on the vision outcome in the first minutes or hours.

> ... compress to 2 ATA on 100% oxygen ... if vision improves significantly at 2 ATA, remain at this depth for 90 minutes ... if vision fails to improve significantly at 2 ATA ... compress to 2.4 ATA. If vision does not improve significantly at 2.4 ATA, compress to 2.8 ATA. If no improvement occurs after the first 20-minute breathing period, consider conducting a Table 6.

From the point of view of this reviewer, this protocol is not rational. As above mentioned, HBO is neither a reperfusion nor a recanalization therapy. So, as the potential role of HBO is maintaining retina in good status waiting for the moment of its spontaneous reperfusion, an immediate recovery after the first sessions shall not be expected. Interrupting the treatment in the first or second day expecting an immediate recovery, that in practice very rarely happens, will refrain the patient from a possible favourable outcome after some days whether the therapy had been maintained. This is supported by the observation that in cases in which HBO was applied in the first hours after the onset, the improvement or even the full recovery of vision was obtained between 7 and 14 days after the start of the therapy[149]. Consequently, expecting a recover of vision after the first treatments, or assuming that HBO can only be useful when applied in the first hours, are non rational assumptions.

RANDOMIZED CONTROL GROUPS ARE NOT STRICTLY NECESSARY IN CRAO. Based on the previously explained convictions, the CRAO patients under study must be accurately followed by ophthalmologists applying all diagnostic and validation measures needed. But it does not seem rational to deny the only promising therapy for a patient that has suffered a CRAO in order to follow a guideline only based in rigid statistical methodology. Some authors and ophthalmologists consider non acceptable from an ethical point of view to create a control group of CRAO patients who will not receive HBO. From the point of view of these reviewers, the ECHM should recommend not to perform any randomized study with patients affected of CRAO. Simply a Central register of patients being treated with HBO from all European countries would be very useful.

7. COST IMPACT

It is very difficult to estimate which is the social cost of a permanent blind in Europe in relation to their consequent level of resulting handicapping, and the permanent persistence of this condition. On the base of documents and research done by the **European Forum Against Blindness**[172] (EFAB), and considering as well some reports made by official specialized institutions, the following considerations must be taken into account.

A study of six countries (France, Germany, Italy, Slovakia, Spain and the UK) found approximately 716,000 people to be blind and many more affected by conditions causing low vision[173]. The total economic cost of vision impairment and blindness includes two components;

actual financial costs and the economic valuation of the burden of disease. The financial cost includes direct health care costs, productivity losses, informal care costs and added welfare losses. This was valued at €2.1€ billion in Ireland in 2010, which is projected to rise to nearly €2.0€ billion but this is projected to rise to €2.4€ billion by 2015 and €2.7€ billion by 2020. According to a new pan-European health economic study, "*An improved quality of life can be gained by investing in screening programmes, earlier diagnoses and adequate treatment of retinal conditions*". Cost-effective interventions offset economic costs, is estimated to be over 32 billion Euros. However, it must be considered that the main causes for blindness are diabetic retinopathy, age-related macular degeneration, and other general conditions of which CRAO is only a small part.

The cost per blind person in Europe varies among countries, but it can be estimated between 10 and 15,000 € per year. The average cost of one HBO session varies in Europe between 50 and 200€. The most frequent fees range between 100 and 150€. Consequently, the full treatment of HBO for an Acute CRAO patient, following the protocol suggested above would be among 1,000 to 4,000€, but the most frequent fees are 2,000-3,000€ for only once in the CRAO patient's life time.

Taking into account the high cost of a permanent blindness in terms o disability and social expenses, and considering as well that no drug has been erected as a valid, essential, or simply widely recommended, it seems reasonable to conclude that the application of HBO in cases of CRAO is highly effective and cost rationale.

8. CONCLUSION - RECOMMENDATIONS

1. As no other therapy has proved to be efficient, HBO should be recommended in all patients suffering from a CRAO, to be applied as soon as possible.
   Recommendation : Type 1 - Evidence level : B
2. HBO therapy should not be denied in delayed patients that suffered the CRAO up to 21 days before.
   Recommendation : Type 2 - Evidence level : C
3. An immediate recovery of vision, or an improvement in the first day, shall not be expected since HBO is not a central artery recanalizing therapy, but it can maintain the still non necrotic but hypoxic retinal cells in rather good conditions while expecting its spontaneous reperfusion.
   Recommendation : Type 1 - Evidence level : B
4. It is highly recommended to maintain HBO therapy during 21 days, in order to awake the retinal cells in ischemic penumbra once the spontaneous recanalization of the central artery is achieved.
   Recommendation : Type 2 - Evidence level : C
5. Being CRAO a highly acute and oxygen dependent disorder, is necessary to apply at least one HBO session daily, all days of the week, within an interval not greater than 24 hours.
   Recommendation : Type 1 - Evidence level : C
6. As the possibility of a spontaneous recovery is extremely rare, a randomized study does not seem to be strictly mandatory and would be deleterious for patients in the control group.
   Recommendation : Type 2 - Evidence level : C
7. As CRAO is not a frequent event, a multicentre collaborative paneuropean international prospective study would be highly interesting.
   Recommendation : Type 1 - Evidence level : C
8. If a Multicentre control group will be difficult, a recommendation instead would be to create a Centralized Register in which after having defined the best and essential protocols, entry

and exclusion criteria, minimal requirements, essential guidelines and best HBO practice, a large database will be reinforced with data proceeding from different centres of many countries.
Recommendation : Type 1 - Evidence level : C

9. Providing that the cost of a full hyperbaric treatment, for once in the life time of patients, is low if compared to the whole cost of a permanent blindness, from an economic point of view it seems very rational to recommend HBO for all patients that have suffered a CRAO.
Recommendation : Type 1 - Evidence level : C

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