**Retinitis pigmentosa**

Marco GELSOMINO[12], Claude LAE[13], Michel PELLEGRINI[1], Jean Yves BERNEY[1], Rodrigue PIGNEL[1]
[1]Geneva University Hospitals (Switzerland)
[2]Hyperbaric centre, Basel (Switzerland)
[3]Centre Hospitalier Alpes-Leman (France)

## Background:

- **Incidence:**

  Retinitis pigmentosa (RP) is a group of inherited retinal degenerative dystrophies, characterized by the degeneration of rod and cone photoreceptor and progressive loss of peripheral and central vision (1). RP may occur alone or as part of a syndrome. One genetic mutation can cause different symptoms in different individuals, and the same syndrome may be caused by different mutations (2). The people first describe progressive lost of night and peripheral vision, then restricted visual field and diminished vision.
  The prevalence in the world is around 1/4000-5000 (3).

- **Clinical manifestations:**

  RP is often diagnosed in children and young adults.
  Night blindness is one of the earliest symptoms and could noticed only in an advanced stage. Another common symptom is the progressive constriction of the visual field, first in the midperiphery of the visual field, then extending in the periphery (4).
  Visual acuity may be retained for years, despite the extension of lost of peripheral vision, but it very variable between the affected patients. The functional impact of RP in the dailies activities is more correlated with loss of visual acuity.
  Other symptoms include photopsias an headache.
  The typical course of RP is gradual loss of visual field, visual acuity and electroretinographic activity over time (estimated by the cone photoreceptor cone electroretinogram response).

- **Treatment:**

  At the moment there is no definitive treatment for RP. Treatments aim to manage some clinical manifestations. Gene therapy, transplantation, and implanted electrical devices, are part of new developing treatments.

Some forms of RP are thought to be due to nutritional deficits, hence the use of high-dose vitamin A supplementation to slow the rate of decline of the amplitude of the cone photoreceptor cone electroretinogram (ERG) response. Omega-3 fatty acid (DHA) may regenerate rhodopsin, as it is a major structural lipid of retinal photoreceptor outer segment membranes (5). Benefits are only demonstrated by observational studies and no randomized controlled trials exist.

Other experimental treatment for RP, under investigation, include gene therapy, transplantation of fetal retinal cells or stem cells, and electronic retinal prostheses.

The later stage of RP is macular edema, which is usually treated with an oral carbonic anhydrase inhibitor (6).

**Rationale for HBO use:**

- A high oxidative metabolism is seen in retinal photoreceptor cells in normal conditions, therefore they depend on metabolic speed and, consequently, on oxygen partial pressure in peripheral tissues. In the presence of abnormal proteins, or phototransduction alterations (leading to photoreceptor retinal damage), more energetic support is needed to maintain a minimal visual function. HBO could complete the metabolic demand by increasing oxygen availability and therefore reduced the damage progression of the visual loss (8).

**Evidence – Based review of HBO use:**

- There is no published randomized controlled clinical trial which include HBO and RP. Evidence is therefore of low level.

  The MEDLINE and RUBICON repository were searched with the query: "Hyperbaric oxygen therapy" and "Retinitis pigmentosa". 10 records were identified. We obtained 2 records after excluding those with no reporting data, commentary or those with abstracts only.
- The effects of HBO therapy were evaluated in two studies by Vingolo et al. The first study included 24 patients in the HBO group and 24 in the control group. Patients were treated with 100% $O_2$ at 2.2 ATA for 90 min, in the 1$^{st}$ month: 5 treatments per week, in the following 11 months: one week of 5 treatments per month and then in the next 2 years: one week of 5 treatments every 3 months. The study showed an improvement of low-noise ERG in 11% and unchanged levels in 89% of patients in the HBO treatment group, while 62% of patients in the control group showed worsening of ERG and 38% remained unchanged with a significant difference between groups ($p < 0.001$) (7). This is

a small study with a restricted selection of patient population, because those severely affected were not included. Another important point is that the endpoint of this study was the ERG response, which is not completely correlate with the visual acuity.

- The other study compared HBO to vitamin A treatment and showed that HBO group (44 patients) had a slower decline in visual function, a higher percentage of visual field stabilization, and an improvement of low-noise ERG b-wave amplitude compared with the control group (44 patients). The treatment regimen was the same as the previous study. Some negative points of the study are the lack of information regarding the dose regimen of the control group (vitamin A group) and the fact that the ERG instrument was changed after 3 years (8).

**Patients selection for HBO**

- Patients with Retinitis pigmentosa

**Current protocol**

- 100% $O_2$ at 2.2 ATA for 90 min
  - 1st month: 5 treatments per week.
  - Next 11 months: one week of 5 treatments per month.
  - Following years: one week of 5 treatments every 3 months.

**Cost impact**

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**References:**


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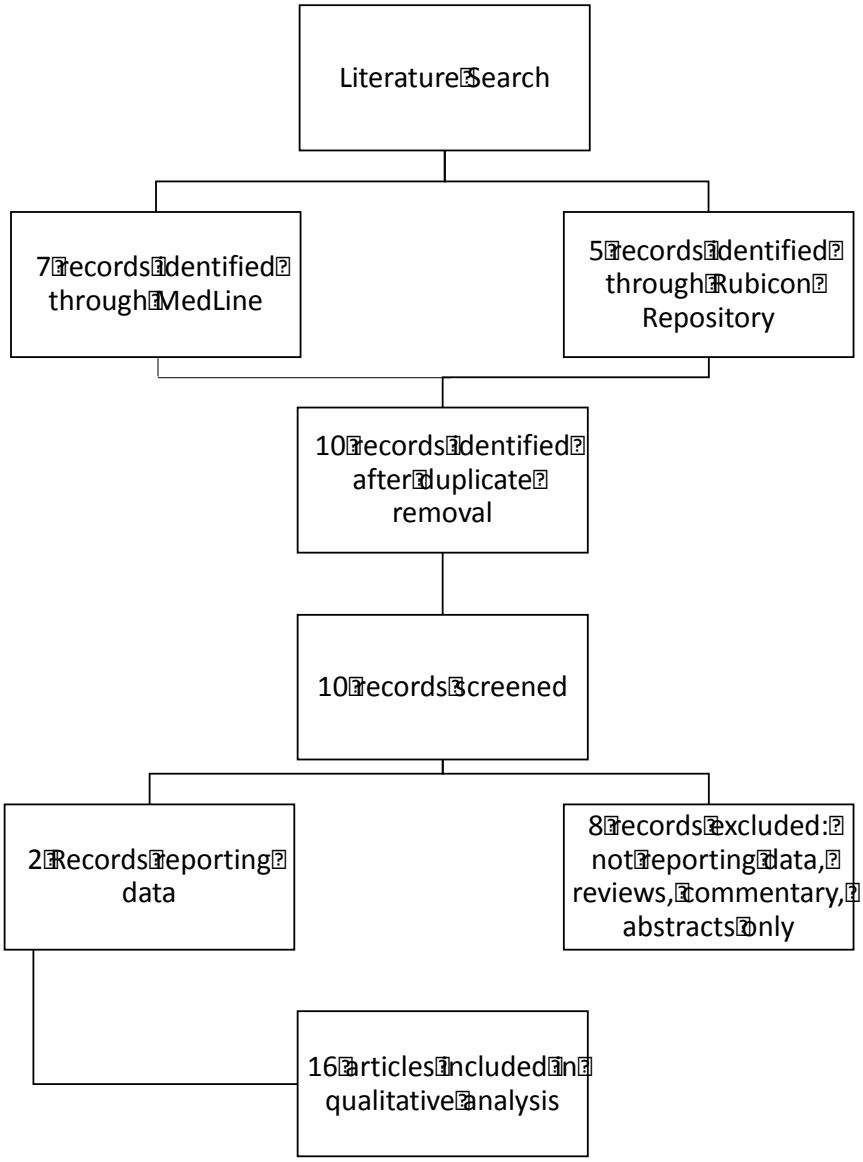
8. Vingolo EM, Rocco M, Grenga P, Salvatore S, Pelaia P. Slowing the degenerative process, long lasting effect of hyperbaric oxygen therapy in retinitis pigmentosa. Graefes Arch Clin Exp Ophthalmol. 2008;246(1):93-8.

**Conclusion: Recommendation**

- It could be reasonable to use HBOT to stabilise the disease (level 3), but more studies are needed. The evidence level is low (grade C)


Literature Search
7 records identified through MedLine
5 records identified through Rubicon Repository
10 records identified after duplicate removal
10 records screened
2 Records reporting data
8 records excluded: not reporting data, reviews, commentary, abstracts only
16 articles included in qualitative analysis

| Study (authors, year) | Type | Nb patients | Aim(s) / Evaluation criteria | Inclusion / Exclusion criteria | HBO protocol (pressure, time, nb of session) | Results | Conclusion / comment |
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| Vingolo 1999 | RCT Not double blinded | 48 (24 HBO, 24 Control) | Electroretinographic (ERG) modifications | Diagnosis of RP with clearly identified inheritance. Specific criteria and ERG data were utilised to aid diagnosis. | 100% $O_2$ at 2.2 ATA for 90 min. 1st month: 5 treatments per week. Next 11 months: one week of 5 treatments per month. Year 2 and 3: one week of 5 treatments every 3 months. | Improvement of low-noise ERG in 11% and unchanged levels in 89% of patients in the HBO treatment group, while 62% of patients in the control group showed worsening of ERG and 38% remained unchanged with a significant difference between groups ($p < 0.001$) | This Study showed only an improvement in ERG, which not necessarily means a change in visual activity. |
| Vingolo 2008 | RCT Not double blinded | 88 (44 HBO, 44 Control) | Comparison Vitamin A to HBO treatment: - Visual acuity - Goldmann perimetry - Static perimetry | Inclusion: clearly hereditary RP; best corrected visual acuity (BCVA) ≥0.50 logMAR; visual | 100% $O_2$ at 2.2 ATA for 90 min. 1st month: 5 treatments per week. Next 11 | Slower decline in visual function, a higher percentage of visual field stabilization, | However, in this study the dose regimen of the control group (vitamin A group) was |

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| | | | - Humphrey field analyzer (HFA)<br>- Electroretinogram | field ≥3 degree diameter circle; and recordable ERG.<br><br>Exclusion: Sporadic RP; BCVA ≤0.50 logMAR; visual field ≤3 degree diameter circle; and unrecordable ERG. | months: one week of 5 treatments per month.<br>Year 2 to 9: one week of 5 treatments every 3 months. | and an improvement of low-noise ERG b-wave amplitude. | not specified, the dropouts were not described, and the ERG instrument was changed after 3 years.<br>HBO could play a role in the stabilisation of the disease condition. |
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