Is there a real benefit of hyperbaric oxygenotherapy in the treatment of necrotizing otitis externa?

L'oxygénothérapie hyperbare: apporte-t-elle un réel bénéfice dans le traitement de l'otite externe nécrosante?

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RÉSUMÉ

Introduction: L'otite externe nécrosante demeure une affection sévère pouvant mettre en jeu le pronostic vital des patients diabétiques. Beaucoup d'approches thérapeutiques ont été décrites mais qu'en est-il de la place de l'oxygénothérapie hyperbare dans la prise en charge de cette maladie ?

Méthodes : Les auteurs rapportent une série rétrospective à propos de 42 patients traités pour une otite externe nécrosante sur une période de 9 ans (2006-2014). Les patients ont été traités soit par antibiothérapie seule (23 cas) soit par l'association : antibiothérapie et oxygénothérapie hyperbare (19 cas). L'évolution, au sein des 2 groupes, a été jugée sur des critères cliniques, biologiques et radiologiques.

Résultats : L'étude comportait 42 patients diabétiques avec un âge moyen de 67 ans (50 à 84 ans) et un sex-ratio de 0,82. Le diagnostic a été porté sur des critères cliniques et bactériologiques chez des patients diabétiques. Un scanner des rochers et une scintigraphie au Technétium ont été réalisés afin d'évaluer la topographie et le degré de la lyse osseuse. Une antibiothérapie a été prescrite par voie intraveineuse puis relayée par voie orale pendant 8 semaines (5 à 15 semaines). L'oxygénothérapie hyperbare (OHB) a été administrée pour 19 patients avec en moyenne 20 séances par patient. La guérison a été affirmée sur des critères cliniques, biologiques et radiologiques. L'otalgie a disparu après 11 jours dans le groupe n'ayant pas eu d'OHB et après 5 jours avec OHB. L'otorrhée persistait jusqu'au 13ème jour en l'absence d'OHB et jusqu'au 6ème jour avec OHB. L'amélioration ou la disparition de la paralysie faciale survenait chez 75% des patients quand l'OHB a été associée. Une guérison complète de la maladie a été affirmée chez 36 patients (86%). Ce taux était de 100% dans le groupe traité par OHB et dans 74% dans le groupe traité uniquement par les antibiotiques. La récidive de l'affection a été diagnostiquée chez 6 patients n'ayant pas reçu d'OHB. L'arrêt de l'antibiothérapie orale a été guidé par les résultats de la scintigraphie osseuse au Gallium.

Conclusion : L'oxygénothérapie hyperbare doit être associée dans le traitement de l'otite externe nécrosante. Les résultats de notre étude suggèrent un bénéfice réel de cette thérapeutique sur les paramètres cliniques, biologiques et radiologiques de cette affection.

Mots-clés
Otite externe nécrosante, diabète, antibiothérapie, oxygénothérapie hyperbare.

SUMMARY

Introduction: Necrotizing otitis externa remains a severe and sometimes life-threatening disease in diabetic patient. Many therapeutic approaches have been described but what about the real benefit of hyperbaric oxygenotherapy in the management of this disease?

Methods: The authors reported a retrospective study about 42 patients treated for necrotizing external otitis over a period of 9 years (2006 to 2014). The patients were treated either by only antibiotherapy (23 cases) or with both antibiotherapy and hyperbaric oxygenotherapy (19 cases). The evolution under treatment was appreciated in the two groups through clinical, biological and radiological parameters.

Results: The study included 42 diabetic patients with a mean age of 67 years (50 to 84 years). The sex-ratio M/F was 0.82. The diagnosis of necrotizing otitis externa was assessed through clinical and bacteriologic criteria in diabetic patients. A temporal bone CT-scan and a technetium scintigraphy were performed in order to precise the topography of the disease and the level of bone lysis. Antibiotherapy was prescribed intravenously and then orally for a mean period of 8 weeks (5 to 15 weeks). Hyperbaric oxygenotherapy was given for 19 patients (average: 20 sessions). The recovery was affirmed on clinical, biological and radiological features. Otalgia disappeared at the 11th day of treatment without HOT and at the 5th day with HOT. Otorrhea disappeared at the 6th day of treatment by HOT and at the 13th day without HOT. The recovery or the regression of facial palsy occurred in 75% of the cases when HOT was given. The total recovery from the disease was diagnosed in 36 patients (86%). The rate of recovery was 100% in the group treated by HOT and 74% in the group treated by only antibiotics. The recurrence of the disease was noted in 6 patients that haven't benefited from HOT. The end of the oral therapy was guided by the results of the Gallium bone scintigraphy.

Conclusion: Hyperbaric oxygenotherapy must be associated in the treatment of necrotizing otitis externa. The results of our study suggest a real benefit of this therapy regarding clinical, biological and radiological parameters of this severe affection.

Key-words
Necrotizing otitis externa, diabetes, antibiotherapy, hyperbaric oxygenotherapy.

Necrotizing otitis externa (NOE), is a rare and sometimes a potentially life-threatening disease of the external auditory canal (EAC) and the temporal bone [1,2]. It was first described a half century ago, as a case of progressive Pseudomonas osteomyelitis in the temporal bone of a patient who had diabetes [3]. Due to the rarity of the disease, evidence-based criteria with regard to diagnostic procedures and treatment schedules are not well established [4,5]. Therapeutic approaches remain controversial with regards to their real efficiency. Thus, we try to analyze in this study the impact of hyperbaric oxygenotherapy in the treatment of NOE.

METHODS

Our retrospective study included 42 patients treated for NOE over a period of 9 years (2006 to 2014). Twenty-three patients were treated by only antibiotherapy and 19 patients were treated by both antibiotherapy and hyperbaric oxygenotherapy (HOT). The evolution under treatment and the follow-up were appreciated through several parameters: clinical (patient's complaints, otoscopic findings), biological (blood cell count, sedimentation rate, C-reactive protein) and radiological parameters (temporal bone computerized tomography, technetium scintigraphy and Gallium scintigraphy). The collection of data was done through the medical records of the patients in the department of otolaryngology and of hyperbaric oxygenotherapy. The protocol of administration of HOT was standardized for all the patients: one session per day of 90 minutes at the pressurization of 2.5 absolute atmospheres. The patients who didn't benefit from HOT were those treated before the onset of the department of HOT (before 2009), those who were claustrophobic and didn't tolerated the procedure and those who had medical contra-indications (CI) of the therapy: cardiovascular CI (severe hypertension, heart arrhythmia, untreated coronaropathies), respiratory CI (asthma, pneumothorax, emphysema), neurological CI (epilepsy), oto-rhino-laryngological CI (severe Eustachian tube dysfunction).

RESULTS

The mean age of our patients was 67 years (50 to 84 years). The sex-ratio M/F was 0.82. The side of the affection was right in 18 cases (43%), left in 23 cases (55%) and bilateral in one case. All our patients were diabetic. The mean delay before diagnosis was 30 days. Severe otalgia was the main complaint (100% of the patients). It was associated to otorrhea in 27 cases. Six of our patients had facial palsy at initial presentation. The external auditory canal (EAC) was inflammatory and contained purulent discharge in 81% of the cases. Neither lymph nodes, nor sensitivity of the temporo-mandibular joint have been noted in our patients.

Blood sedimentation rate was accelerated in 32 patients (average 72 mm/h) and blood cell count found hyperleukocytosis in 27 cases. Pseudomonas Aeruginosa was the causal agent in 39 cases and Pseudomonas Fuorescens in 3 cases.

CT-scan was performed in 90% of cases; it showed bony lysis in 33 cases (Fig 1).

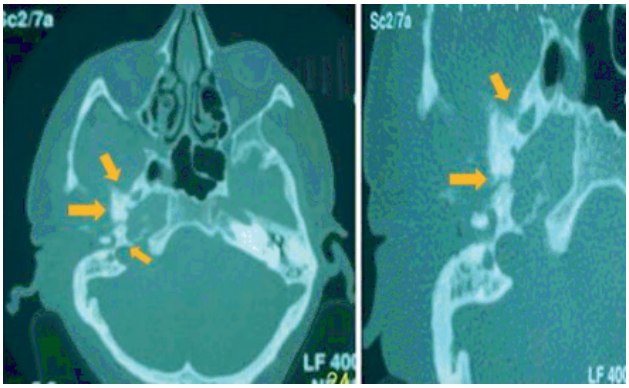

Figure 1: Axial computed tomographic (CT) showing bony destruction of the right temporal bone. Note the missing posterior wall of the external auditory canal (arrows).

Antibiotherapy was prescribed intravenously and then orally for a mean period of 8 weeks (5 to 15 weeks). It consisted of a combination of third-generation cephalosporin (Ceftazidime: 6 g/d) with Fuoroquinolones (Ciprofloxacin: 800 mg/d) in 34 cases; a third-generation cephalosporin with aminoglycoside (Gentamycin: 3 mg/kg/d) in 5 cases and Fuoroquinolones with aminoglycoside in 3 cases. After 3 to 4 weeks of intravenous therapy, an oral antibiotherapy with Fuoroquinolones (Ciprofloxacin: 1000 to 1500 mg/d) was prescribed for all the patients. The therapy included also a local treatment of the external auditory canal including cleaning under microscope and application of antimicrobial drops.

In association with parenteral antibiotherapy, 19 patients benefited from hyperbaric oxygenotherapy with a mean of 20 sessions per patient. The protocol of administration of HOT was standardized: one session of 90 minutes per day at the pressurization of 2.5 absolute atmospheres (Fig 2). The patients who didn't benefit from HOT were those treated before the onset of the department of HOT (before 2009), those who were claustrophobic and didn't tolerated the procedure and those who had medical contra-indications of the therapy (severe hypertension, heart arrhythmia, untreated coronaropathies, asthma, pneumothorax, emphysema, epilepsy, severe Eustachian tube dysfunction.

The follow-up began since the recovery period and was prolonged until the recovery of the patient that was affirmed on clinical, biological and radiological features.

Otalgia disappeared at the 11th day of treatment without HOT and at the 5th day with HOT. Otherwise, otorrhea disappeared at the 6th day of treatment by HOT and at the 13th day without HOT (Table I).

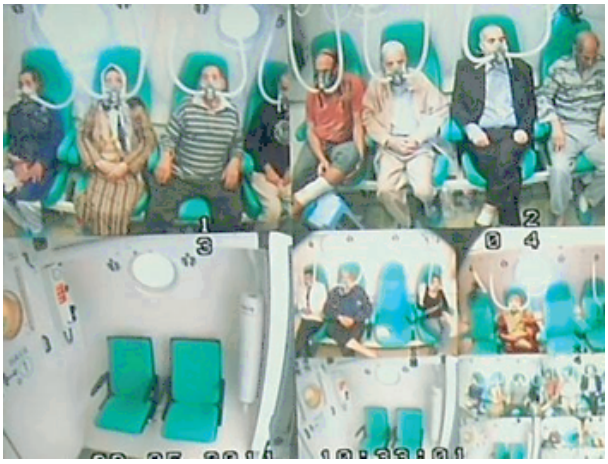

Figure 2: Session of oxygenotherapy in a pressurized room.

Table 1 : Evolution of symptoms with respect to the therapeutic protocol.

	Otalgia	Otorrhea
Antibiotics	11 days	13 days
Antibiotics + HOT	5 days	6 days

The recovery or the regression of facial palsy occurred in ¾ cases when HOT was given. A stagnation (1 case) and a worsening (01 case) of the facial palsy were observed when HOT wasn't prescribed (Table II).

Table 2 : Evolution of facial palsy under treatment

Patient	1	2	3	4	5	6
Traitement	A+HOT	A+HOT	A+HOT	A+HOT	A	A
Initial testing	11/30	8/30	7/30	12/30	15/30	12/30
Final testing	30/30	30/30	20/30	12/30	15/30	7/30

The total recovery from the disease was diagnosed in 36 patients (86%). The rate of recovery was 100% in the group treated by HOT and 74% in the group treated by only antibiotics. The recurrence of the disease was noted in 6 patients that haven't benefited from HOT (Table III). These 6 cases was re-treated by intravenous and then oral antibiotherapy with a good outcome. The end of the oral therapy was guided by the results of the Gallium bone scintigraphy (Fig 3) and the normalization of the biological parameters (blood sedimentation rate and C-reactive protein).

Table 3 : Recovery and recurrence rates with regards to the therapeutic protocol

	Recovery	Recurrence
Antibiotics	74%	26%
Antibiotics + HOT	100%	0%

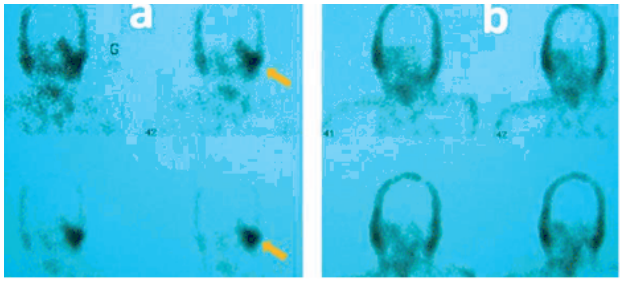

Figure 3 : Gallium bone scintigraphy showing the evolution of bony fixation before (a) and after the end of therapy (b).

DISCUSSION

Necrotizing otitis externa is an aggressive and potentially life threatening infection of the soft tissues of the external ear and the surrounding structures [1].

Predisposing factors include immunologic abnormalities such as diabetes, dermatitis, immunosuppressant drugs, neoplasm, iatrogenic procedures and chronic infection of the ear canal [6].

The pathogenesis of this condition still unclear and seems to be the end stage of a severe infection that originates from the external auditory canal and progresses through cellulitis, chondritis, peri-osteitis, osteitis and finally osteomyelitis [4]. Once periosteitis develops, it may progress rapidly through the skull base. As a result, facial nerve and other cranial nerve palsies may appear [7].

The most common causative pathogen is Pseudomonas Aeruginosa in over 95% of the cases, but cases of Staphylococcus, Candida and Aspergillus have also been reported [8].

Important principles of treatment include aggressive control of diabetes, reversal of acidosis, and improvement of immunocompetency where possible, in association to a specific medication against the causative agent. Thus, many therapeutic approaches, protocols and medical agents have been proposed by the authors in the literature [1,4,9].

However, there was unanimity among all the authors about the necessity of a long-term antibiotic therapy given intravenously and then orally and guided by the bacterial samples' culture for at least 6 to 8 weeks [2].

As prescribed for our patients, the most recommended antibiotics used in this affection are different combinations of third-generation cephalosporin, Fuoroquinolones, and aminoglycoside. The choice of the drugs is related to the

causative agent, the antibiotic sensitivity tests, the antibiotic allergies and the patient medical conditions.
A prolonged therapy and the combination of drugs are needed to sterilize the osseous infection and to prevent resistance of the bacterial agents [5].
The local treatment is also recommended to clean the external auditory canal from any purulent discharge or granulomas and to apply local medical drops.
Hyperbaric oxygenotherapy have been described by many authors as an efficient adjuvant therapy in the management of necrotizing otitis externa [10]. Indeed, HBO increases the partial pressure of oxygen, improving hypoxia and allowing greater oxidative killing of bacteria [11].
However, according to other authors, the role of HBO in managing NOE is not well established. A thorough review of the Cochrane Database, Medline, and Embase found no randomized controlled trials of HBO in NOE and concluded that no clear evidence exists to show the real efficacy of HBO compared with antibiotic or surgical treatment [12-14].
Some otolaryngologists have advocated its use only in NOE with refractory skull base osteomyelitis [15-17] and intracranial involvement [18]. It requires daily treatments for several weeks and side effects include oxygen toxicity, barotrauma, and tympanic membrane perforation [19].
The present study has showed that the combination of HOT with antibiotic therapy enhances the general outcome of NOE by increasing the total recovery rate of the disease, reducing the frequency of recurrences and accelerating the regression of clinical signs: complaints, inflammation of the external auditory canal and facial palsy. Larger series of the disease and precisions with regards to the follow-up parameters and the criteria of recovery will allow making reliable conclusions about the efficiency of HOT in the management of necrotizing otitis externa.

CONCLUSION

Hyperbaric oxygenotherapy must be prescribed in the therapeutic approach of necrotizing otitis externa. Obviously, this therapy is associated with an excellent outcome with regarding clinical symptoms, biological and radiological parameters. Randomized controlled trials have to be conducted in order to affirm the evidence of the efficacy of HBO in NOE.

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