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Clinical Note

Hyperbaric oxygen therapy in cluster headache

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Summary Preliminary reports have shown that hyperbaric oxygen (HBO) interrupts cluster headache (CH) attacks. In the present study, 6 of 7 patients with episodic cluster headache who were treated with hyperbaric oxygen experienced an interruption of the attack. In 3 of 6 responders the florid period of the cluster headache was interrupted. The other 3 patients remained without pain attacks for a period lasting from 3 to 6 days. In 6 different patients, a placebo treatment had no effect. The present findings clearly indicate that hyperbaric oxygen has not only a symptomatic effect on a single attack of cluster headache, but it also could prevent the occurrence of subsequent attacks.

Key words: Cluster headache; Hyperbaric chamber; Oxygen therapy; Cerebrovascular district

Introduction

Cluster headache (CH) is characterized by a series of sudden attacks of severe pain accompanied by autonomic symptoms, localized in an area around the eye on one side. Usually the attacks occur daily (1 to several a day, typically at a fixed hour) for a period lasting from 1 to several months.

Administration of oxygen during the CH attack has been demonstrated to reduce/interrupt the pain attack in 70% of the patients (Kudrow 1981; Fogan 1985). The percentage appears to be less in our clinical experience. This effect may be due to a vasoconstrictive action of the oxygen (Nakajima 1983). Moreover, the beneficial effect, when present, is often short-lasting in comparison with the duration of the attack. For these reasons the use of this procedure is limited. Preliminary reports indicate that the administration of hyperbaric oxygen (HBO) is effective in relieving the CH attacks (Porta et al. 1991; Weiss 1989) and this effect may be caused by a strong vasoconstriction in the cerebrovascular bed (Miller 1981). This study evaluates the effect of HBO on CH attacks in 7 patients affected by an episodic form. This effect was compared with that obtained in 6 patients by using a placebo procedure (exposure to the hyperbaric chamber, without administering HBO).

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Subjects and methods

Thirteen patients (12 men and 1 woman) suffering from an episodic form of CH participated in the study: 7 (mean age: 45.8±4.8 years) were administered with HBO and 6 (mean age: 42.3±5.2 years) underwent the placebo procedure. The diagnosis was made following the criteria of the Ad hoc Committee on Classification of Headache (Headache Classification Committee 1988). Before admission to the trial, each patient was given a complete physical examination. A careful otorhinolaryngoiatric visit was also performed. The instrumental examination also included radiography of the chest and electrocardiography. Patients suffering from diseases other than CH were excluded; also excluded were patients who were taking drugs used in the prophylaxis of headache. Informed consent was obtained in each case. The patients were in the florid phase of the CH attacks, from 10 to 15 days after its initiation. Each patient was examined at the time of an attack. Five minutes after onset of the attack the subjects were placed into a pluriplace-pluriambient hyperbaric chamber (Galeazzi). The 7 patients receiving the effective treatment reached a 15 mt depth (2.5 atmosphere absolute (ATA)) at a descending rate of 0.8 mt/min by compressed air (Sukoff and Ragatz 1976). After placing them in the chamber, the pressure was gradually increased to 2.0 ATA over a 15-min period. The patients chosen for the placebo procedure were placed in the same environment without

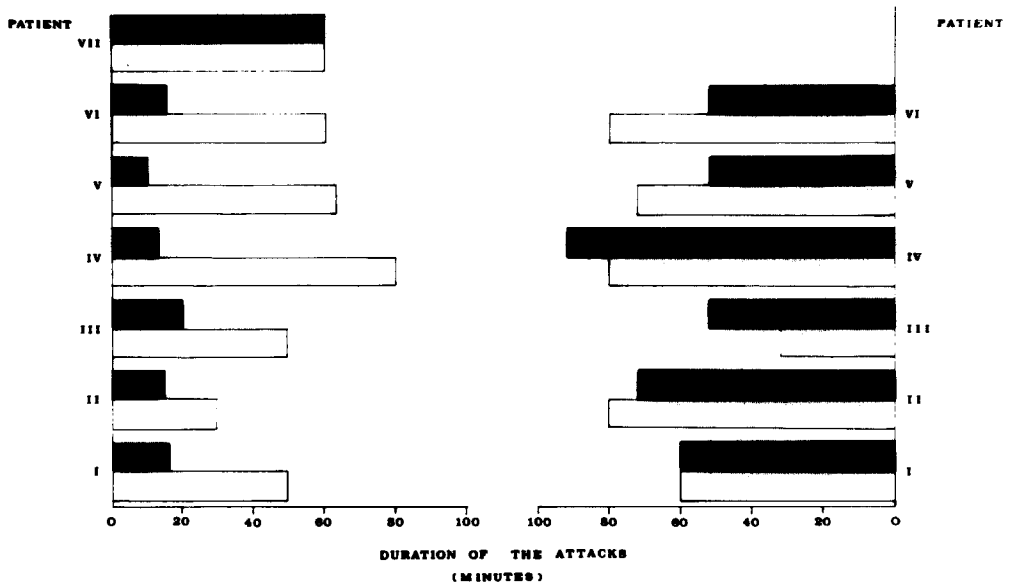

Fig. 1. Duration of cluster headache attacks in each patient before (empty bars) and during (filled bars) exposure to the hyperbaric chamber. The value before treatment is an arithmetical mean of the duration of the 3 attacks preceding the test. Patients receiving hyperbaric oxygen are represented on the left; patients not receiving the effective treatment (placebo procedure) are represented on the right.

administering HBO. For all patients (either those receiving the effective treatment or the placebo) exposure to the hyperbaric chamber lasted 30 min. An observer who did not know the nature of the administration registered the duration of the attacks during treatment. The arithmetical mean of the duration of the last 3 attacks, occurring before the test, was computed and compared to the duration of the attacks occurring during HBO administration. Chi-square analysis was used for this purpose. After exposure to the hyperbaric chamber each patient was followed up for the duration of the cluster period.

Results

In 6 out of 7 patients, HBO resulted in an interruption of the current CH attack, ranging from 5 to 13 min after the onset of treatment. The remaining patient did not show any significant change in duration/intensity of the attack. The duration of the attacks present during the treatment session was statistically reduced in comparison with values before the test ($P < 0.01$, chi-square test) (Fig. 1). None of the patients who were chosen for the placebo procedure showed changes in the duration of their attacks, and no statistical difference was found in comparison with the values before the test (Fig. 1). During the follow-up period, lasting 2 months, among the patients in whom a beneficial effect was observed, 3 reported complete interruption of their cluster period. In the other 3 patients, CH attacks were not present for a period lasting from 4 to 6 days. After such a period the attacks reappeared with the same intensity and duration as during the pre-treatment period. The patient who was insensitive to HBO was treated again in the hyperbaric chamber (this time not during an attack) but also in this case no beneficial effect was observed. In the patients undergoing the control procedure the occurrence of successive CH attacks remained unmodified. Adverse reactions (particularly barotrauma) were not observed in any patient.

Discussion

The present results demonstrate that exposure to HBO has a beneficial effect on the pain attacks of patients suffering from CH and confirm preliminary findings (Weiss 1989; Porta et al. 1991). In particular, the administration of HBO during an attack of CH dramatically interrupted the pain a few minutes after the onset of treatment. This effect was present in all patients, except one, who underwent treatment. A placebo effect, produced by the procedure required for hyperbaric treatment, is excluded as no changes were found in the duration of the attacks in the group of patients placed into the hyperbaric chamber but not receiving HBO. Administration of pure oxygen (which could directly affect CH attacks) was avoided in the control procedure as the aim was first to eliminate the existence of a placebo effect. The choice of two different groups of patients, one for the real treatment and the other for the placebo procedure, was motivated by the fact that administration of HBO produces easily recognizable sensations (such as ringing in the ears). Such a choice allowed us to carry out a controlled study, along with the fact that the observer recording the effect of the treatment was different from the operator of the hyperbaric chamber and worked under blind conditions. Although not perfect, this is, in our

opinion, the best available way to obtain a double-blind condition, i.e., the ideal in validating data from a therapeutic procedure.

An interesting observation arises from the present study: in 3 patients treated with HBO there was a definitive interruption of the cluster period, whereas in the other 3 patients the CH attacks were not present during the days immediately following treatment. This result indicates that a single treatment in the hyperbaric chamber could also have a long-lasting effectiveness in preventing the occurrence of CH attacks. From this point of view, the procedure could represent a complete therapeutical approach for the syndrome.

Various mechanisms could explain the effect of HBO in CH. First, HBO induces a congruous vasoconstriction (Miller 1981; Fisher et al. 1988); moreover it increases diffusion of oxygen in the tissues, thus possibly reducing cerebral hypoxia. HBO also could have an anti-oedema effect on either the vasal wall or the interstitial space (Sukoff 1968; Sukoff and Ragatz 1982). Finally, another possible explanation for the HBO effect could be the stimulation of serotonin synthesis in the central nervous system (Costa and Meek 1974).

The results of the present study are promising and merit further verification. Particularly interesting would be a controlled comparison between the effects of HBO and oxygen therapy in CH.

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