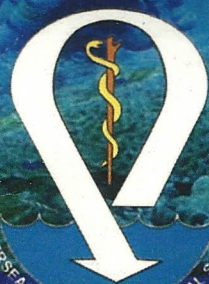
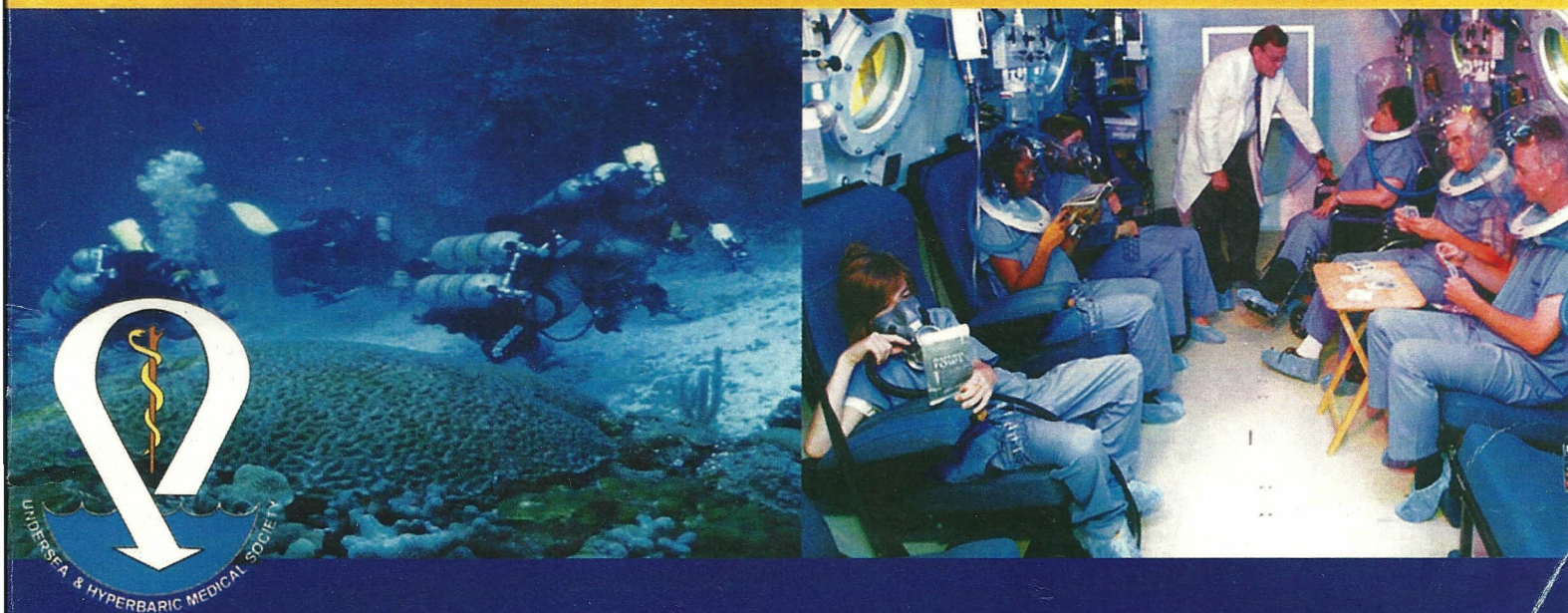


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Anaphylactic shock during hyperbaric oxygen therapy

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ABSTRACT

A case of a 38-year-old woman is reported who was treated with hyperbaric oxygen therapy to cure a dehiscent wound. She suffered from “oral-allergy syndrome” (OAS) while eating certain fruits, and from itching when wearing latex gloves to handle hair dyes.

Fifteen minutes after the start of compression, malaise, anxiety, dyspnoea, tachycardia, cold sweating and laryngeal stridor occurred. Despite intensive care treatment, face angioedema persisted for several days. On the basis of history, radioallergosorbent test (RAST) and prick tests, latex was assumed to be responsible for the anaphylactic reaction.

To our knowledge, this is the first extensive report of an anaphylactic reaction to latex in a hyperbaric chamber. The lesson drawn from this case record can be summarized as follows:

- 1) never fail to collect a thorough history;
- 2) set up a latex-safe hyperbaric chamber when needed;
- 3) have an emergency kit always near at hand.

INTRODUCTION

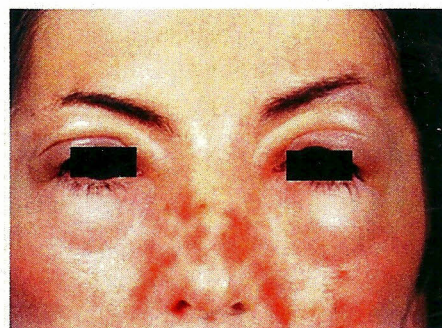
Acute allergic reactions to latex are events that should be dealt with primarily by prevention. The main problem is to identify at-risk patients by an in-depth history, following latex allergy guidelines [1]. Latex allergy can lead to potentially life threatening anaphylactic reactions [2,3,4]. Therefore, not only all HBO₂ patients should be asked about latex allergy, but also divers who complain of itching and hives when donning their dive equipment should be referred to an allergist for further evaluation.

CASE REPORT

A 38-year-old woman was experiencing her third labor. A couple of minutes after intravenous (i.v.) infusion of oxytocin started, an acute widespread wheal and flare reaction took place. The patient also experienced facial angioedema without systemic involvement. The infusion was stopped, an i.v. corticosteroid was administered and labor continued successfully. She had to be episiotomized.

Three days after labor, the episiotomy wound was still dehiscent. Consequently, she was directed to our center to receive hyperbaric oxygen therapy (HBO₂T). Her blood pressure before entering the hyperbaric chamber was 115/70 mm Hg, and her pulse rate was 65 bpm. The compression with mask (100% O₂; 2.8 bar pressure) started; after 15 minutes, malaise, anxiety, itching, rapid and thready pulse, dyspnea and laryngeal stridor occurred.

FIGURE 1 – Facial angioedema



A six-minute decompression was performed, after which the patient was transferred to an intensive care first aid unit, where her blood pressure registered 80/50 mmHg and her pulse rate was 120 bpm. A facial angioedema and widespread urticaria were present. A non-invasive pressure ventilation (Boussignac, CPAP system) and inotropic, bronchodilator and corticosteroid drugs were administered. A partial response to the treatment was achieved within six hours.

After 10 hours the patient was transferred to an emergency ward owing to the persistence of the facial angioedema and urticaria. A clear-shaped blistering erythema was evident on nose, malar and perioral regions, and chin, which were the areas where the face mask had been applied (Figure 1, above).

FIGURE 2 – Mask



She was discharged the following day almost completely asymptomatic, except for the above-mentioned erythema, which persisted for three days despite oral corticosteroid and antihistaminic treatment.

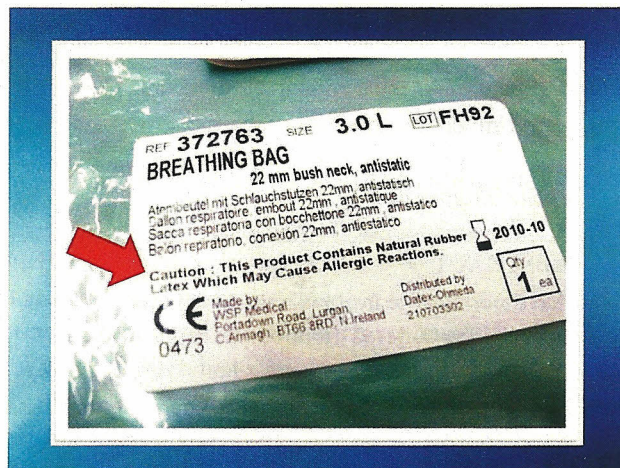
DISCUSSION

A more thorough anamnesis, performed just before discharge, revealed important details omitted in the previously collected history. The patient revealed that she was affected by a recurrent hand dermatitis, which worsened on contact with some crude vegetables, such as tomatoes. Some fruits, such as bananas, produced transient itching and swelling of the mouth mucosa. Moreover, she had suffered several times from intense scalp and face itching on contact with the rubber gloves worn to apply hair dyes.

Apparently our patient was allergic to several unrelated agents: oxytocin; a still-unidentified agent employed during HBO₂T; some components of hair dyes; and some vegetables and fruits. Searching for a unifying diagnostic hypothesis, sensitization to latex (gloves, mask and other medical equipment, foodstuffs cross-reacting with latex) seemed to us the most reliable conclusion.

This assumption was confirmed by the detachment of latex-specific IgE by skin prick test (ALK-Abelló extract, ø 11 mm wheal) and radioallergosorbent test (RAST) (UniCAP Specific IgE : 6.28 kUA/l), performed two weeks after stopping all drug assumption. A prick test with oxytocin (Syntocinon® 5 UI/ml) was negative. Skin prick tests (SPT) with a battery of 42 aero- and tropho-allergen diagnostic extracts turned out positive for grass pollens, even if the patient did not complain of clear rhinitis symptoms. Prick-by-prick performed with crude foodstuffs revealed significant skin reactions to banana, kiwi and avocado.

FIGURE 3 – Mask alert



The patient would not give us the informed consent to be patch-tested, fearing a new skin reaction after contact with rubber haptens.

Since latex sensitization was demonstrated, we guessed that the first reaction was not due to the infusion of oxytocin but to exposure to latex. In the labor room, as well as in the hyperbaric chamber, at least two sources of latex – namely, gloves and medical devices – could have caused the acute reactions by inhalation of airborne particles and skin and mucosa contact.

Some case reports implicate synthetic oxytocin as a cause of allergy, but only a few have been documented by skin tests. In addition, it is doubtful that oxytocin would be able to induce IgE synthesis. By the way, the drug may be irritating, raising false-positive skin responses. No *in vitro* test is available. It is worth noting that some papers report a partial homology between latex and oxytocin molecular sequence, which might indicate the possibility of a cross-reactivity having clinical implications [5].

Despite these suggestions as to a putative cross-reactivity between latex and oxytocin, there is no doubt that the environment of hyperbaric chambers is usually not latex-safe, owing to the presence of latex containing devices and the use of latex gloves by the medical staff. Even if no quantification of aeroallergens was performed by us, it is presumable that high concentrations of airborne latex particles could have been detected.

The main source of latex probably was the mask employed, responsible both for the systemic symptoms by inhalation of small latex particles and for the local reaction from contact of the mask with the face (Figures 2,3, above).

TABLE 1 - Latex products in a hyperbaric chamber

• Mask	• Emagel vial (latex diffusers)
• Breathing bag	• Rubber shoes
• Ambu bag	• Caps, face masks with rubber bands
• Sterile gloves	• Some kind of white coats
• Surgical gloves	• Elastic bandage
• Injection ports and adapters	• Mattresses / pillows of the stretcher
• Tourniquets	• Guedel cannulae
• Sticking plaster	• Foley urinary catheters
• Vial stoppers	

Our case report brings out the necessity of performing an in-depth history before any surgical or medical treatment. In particular for HBO₂T, it is mandatory to look for past and current allergic diseases, especially allergy to latex.

In case of a clinical suspicion, an array of diagnostic tools is available, such as prick, prick by prick, glove test, patch tests, immune-CAP, CAST test, ALASTAT-SYSTEM and Microarray-ISAC [6,7,8,9]. FDA-approved serologic testing shows a high degree of specificity but a low degree of sensitivity in comparison with *in vivo* testing, which is the gold standard.

Sometimes in the history there is evidence of an "oral allergy syndrome," which comprises oral itching and swelling, without systemic involvement, after oral contact with vegetables and/or fruits [10,11,12,13]. Within this context a "latex-fruit syndrome," due to vegetables and fruit cross-reacting, with latex can be discovered simply by asking the patient about it [14]. That was the case with our patient. Moreover, she had experienced scalp and generalized itching from using latex gloves to apply hair dyes. For these reasons she should have been sent to an allergist before undergoing HBO₂T.

Since the end of the 1990s several checklists have been set up all over the world in order to arrange latex-safe areas, particularly in surgical contexts [15].

It is well known that 100% latex-free areas cannot be achieved [16], but there are a few simple measures that can be taken to minimize latex exposure for at-risk-patients [17] in an hyperbaric chamber. In fact, all the latex equipment regularly employed in a hyperbaric chamber (Table 1, above) can be replaced with latex-free materials, such as the latex-free mask ("Sapio Sistemi Integrati Roma") we now always use.

Wherever it is necessary to enter the hyperbaric chamber through an "equilibrium chamber" or to introduce objects within, attention should be paid to avoid any contamination by latex.

Moreover, it is mandatory to have a sealed emergency kit always near at hand on the crash cart, certified and checklisted by the hospital pharmacy. Equipment for intubations and assisted ventilation and anti-anaphylactic drugs should be in the emergency kit.

CONCLUSIONS

The most severe acute allergic reaction – *i.e.*, anaphylactic shock – is a rare event if the afore-said recommendations are followed. Nevertheless, it cannot be absolutely excluded in case of an at-risk-patient treatment.

The case of our patient reminds us that an anaphylactic event due to sensitization to latex is always possible in the hyperbaric chamber setting, even if only one case was recorded in a large series of HBO₂ treatments [18]. In fact, such an event is not usually mentioned in textbooks of hyperbaric medicine [19]. Nonetheless, to help prevent such occurrences, it is mandatory to:

1. perform a latex-oriented history and *in vivo* /*in vitro* tests if the history is positive;
2. set up a latex-safe environment;
3. display "latex allergy" or "latex alert" signs (Figure 4, right);
4. alert the medical, nursing and technical staff (Table 2, below);
5. make sure an emergency kit is always near at hand.

FIGURE 4**TABLE 2 - Recommendations to the medical staff**

- Latex-allergic patients must be the first to be treated in the daily schedule;
- Clean and prepare the hyperbaric chamber by the end of the previous day;
- Use only "powder-free" gloves;
- Identify the latex-safe track with a dedicated sign;
- Post a checklist of the forbidden devices outside the hyperbaric chamber.

Latex allergy has become a relatively frequent occurrence among divers, and more and more of them adopt "latex caution/avoidance" procedures when selecting dive equipment for purchase or rental. These precautionary measures could well be part of the recommendations to hyperbaric facilities staff when collecting the history of a diving patient before treatment.

Finally, it should be noted that neoprene allergy is not that uncommon among divers and that many neoprene wetsuits do contain small amounts of latex. ■

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