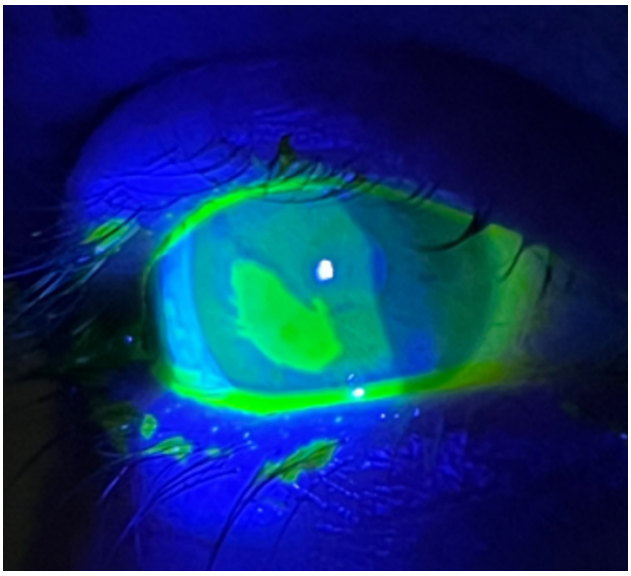
Images in diving and hyperbaric medicine

Blurred vision after diving, what's your diagnosis?

Case and image

We present the case of a 50-year-old woman with no notable antecedents who has been diving for several years without any particular problems (Advanced Open Water Diver, 80 dives in total). She is not currently undergoing any treatment and has no known allergies. In August on the French Mediterranean coast, she participated in a week-long diving trip in the 20-metre zone, with one dive per day. She is not fatigued, is hydrating regularly, is not having trouble sleeping, and is not ill. Her last dive, to a maximum depth of 18 m for a total duration of 44 minutes, proceeded without incident. The ascent speed was correct, and the decompression procedure was respected. On the surface, she immediately noticed blurred vision in her right eye. Once on the boat, she reported her symptoms and was given oxygen at 15 L·min^{-1} before being evacuated to the hyperbaric centre. On admission 1.5 hours after exiting the water, she still had blurred vision, now associated with a burning sensation in her right eye. She described no foreign body event, and did not need to clear her mask during the dive. Examination revealed a white eye with no visible foreign body and normal ocular movement. The right eye is slightly watery with blurred central vision. The remainder of the clinical examination was otherwise normal. The fluorescein examination is shown in Figure 1.

Figure 1
Fluorescein examination of the right eye



What is your diagnosis?

1. Neurological decompression illnesss
2. Ocular barotrauma due to mask squeeze
3. Keratitis due to jellyfish sting
4. Toxic keratitis
5. Herpetic keratitis

Discussion and multiple choice question result

In the presence of visual disturbances on exiting the water, neurological cerebral decompression illness should be the first consideration, as this is an emergency requiring hyperbaric admission as soon as possible.[1] Visual disturbances such as diplopia, visual field changes or, less commonly, cortical blindness may be observed. Decompression sickness is more likely after a dive to a depth greater than 30 meters, or long, prolonged dives requiring decompression stops, repetitive dives, or dives with yo-yos. Rapid ascent with expiratory blockade can also be responsible for pulmonary barotrauma with cerebral air embolism, which can also lead to visual disturbances.[1]

The described case does not correspond to this situation and the history now includes unilateral ocular burning, suggesting a local ocular cause. Examination with fluorescein blue light revealed corneal damage. The etiologic search for a keratitis is then in the foreground.

In novice divers (which is not the case here), failure to compensate for the negative pressure of the mask during descent may result in benign subconjunctival hemorrhage that resolves in a few days, but this form of barotrauma does not manifest as keratitis.[1]

The most common causes of keratitis are traumatic, infectious or allergic. Questioning in this case appears to rule out trauma. Infectious and allergic causes most often result in keratoconjunctivitis, which is not the case here as the conjunctiva is spared. Herpetic keratitis can present as unilateral keratitis, but the most common presentation is that of a corneal ulcer with an arborescent or dendritic appearance. The patient has no history of oral or genital herpes. Keratitis associated with soft contact lens infection could also be considered, as in a case of *Pseudomonas aeruginosa* infection associated with scuba diving,[2] but in our case the patient does not wear contact lenses.

In addition to diving, there may be an environmental cause related to exposure to marine organisms that can cause skin or eye stings. Cases of keratitis have been described after exposure to sea anemones[3] or red coral.[4] In the latter case, ocular damage is triggered by red coral nematocysts, organelles that release toxins. In the Mediterranean, the most likely exposure is to jellyfish or floating debris of jellyfish filaments. In this case, however, facial burns would probably be associated. Furthermore, the absence of mask clearing during the dive rules out this hypothesis.

Upon further questioning, the patient reveals that she had been using a special anti-fog spray to prevent her mask from fogging up. Toxic keratitis associated with the use of anti-fogging agents is a relatively rare cause, but one that we have seen in our hyperbaric center. Mask fogging is a common problem in scuba diving. Applying saliva to the inside of the mask lens limits fogging, but does not always eliminate it. On the other hand, the application of saliva can lead to hygiene problems. This has led to the development of commercial anti-fog products designed for use on diving masks. These products may contain volatile compounds that are potentially toxic to the corneal epithelium, such as glycols, alcohols, surfactants and phenol derivatives.[1] Exposure to these compounds may cause blurred vision, photophobia, lacrimation, and blepharospasm that manifests shortly after diving. Fluorescein examination usually reveals diffuse superficial punctate keratopathy. This complication usually results from improper use of the anti-fogging agent, either by over-application of the product or by failure to rinse the mask prior to application to the face. The instructions for use for anti-fog products clearly state that the mask should be rinsed or wiped thoroughly after application of the spray. However, it has been found that this recommendation is not always followed, and in this case, rinsing was not performed. Wright described two cases of toxic keratitis in recreational divers with symptoms of corneal lesions appearing one to three hours after exposure to these anti-fogging agents.[5] In both cases, corneal lesions were limited to diffuse superficial punctate keratopathy that resolved within 24 hours without scarring or permanent damage. A more recent case describes the occurrence of unilateral keratitis with stromal edema after massive spraying of an anti-fogging agent on swimming goggles.[6] Topical corticosteroids, antibiotic eye drops, and oral tetracycline were initiated. Epithelial involvement and diffuse stromal opacity resolved rapidly, but white subepithelial plaques were observed in the central cornea at the one-year follow-up. These plaques disappeared completely after one month of treatment with topical corticosteroids.

In our case, the involvement was limited to superficial epithelial keratitis. Treatment with antibiotics and vitamin A ointment was initiated, with consultation of an ophthalmologist to monitor progress.

After considering the different diagnoses, the correct answer to the multiple choice question is 4.

References

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