



Case Report

Expert group syndrome at high altitude

Jean-Paul Richalet^{a,b,*}, Marie-Anne Magnan^c, Alice Gavet^d, Pierre Lafère^{e,f}^a Université Sorbonne Paris Nord, Laboratoire Hypoxie et Poumon, UMR INSERM U1272, Bobigny, France^b Institut National des Sports, de l'Expertise et de la Performance, Pôle médical, Paris, France^c Hôpitaux universitaires de Genève, Département de médecine aiguë, Unité de médecine subaquatique et hyperbare, Geneva, Switzerland^d Hôpitaux du Mont-Blanc, Soins de suite et réadaptation, Chamonix, France^e Université de Bretagne Occidentale, Laboratoire ORPHY, EA 44324, Brest, France^f Haute École Bruxelles-Brabant (HE2B), Environmental, Occupational, Ageing (Integrative) Physiology Laboratory, Brussels, Belgium

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ABSTRACT

During a training session for the university diploma of Mountain medicine delivered by University Sorbonne Paris Nord for medical doctors, one of the participants developed signs of maladaptation to high altitude at 3 600 m, the severity of which was incorrectly interpreted. Information was sparingly given by the patient (an anesthetist) to several of his colleagues and no one was in charge to collect clinical data, take a history, and provide appropriate treatment. The combination of the absence of designation of a supervising doctor and the difficulty of communicating with the patient led to a lack of coordinated management and to an evolution of the symptoms towards severe acute mountain sickness. Fortunately, the very rapid management of the patient and a rapid helicopter evacuation, as soon as the symptoms worsened towards the onset of a suspected high altitude cerebral and/or pulmonary edema, allowed rapid resolution without sequelae. Environmental, medical, psychological, and managerial factors led to this *Expert Group Syndrome*.

Introduction

In 2017, a 46-year-old doctor (the patient) participant in the practical training course of the University Diploma in Mountain Medicine presented pathological signs at the Cosmiques refuge (3 600 m above sea level) which lead him to be evacuated by helicopter to the Sallanches hospital. This course has been organized since 1984 by the University Sorbonne Paris Nord and the National School of Skiing and Mountaineering (ENSA) to train doctors in the practice of rescue in isolated high-altitude conditions.¹ Beforehand, the 14 trainee doctors received a week-long theoretical training on the physiology and pathology of high-altitude environment.² The course is supervised by professor-guides from ENSA (named Guide A and Guide B) and doctors specializing in high altitude pathology and mountain rescue (named Dr. A, Dr. B, and Dr. C).

Case report

Day 1 (May 29th, 2017): arrival in Chamonix (1 035 m), training climbing school in Les Gaillands. Nothing special to report.

Day 2: Workshop at Aiguille de Toule (3 524 m) via the Torino refuge. The patient did not show any sign of acute mountain sickness (AMS). During the ascent, his heart rate (HR) monitor showed a maximum HR of 152 bpm. One trainee noticed that the relationship with the patient was very complicated and difficult. During the ascent, they had argued because the patient disagreed about rope management. The following night was spent in Chamonix.

Day 3: Workshop around Cosmiques refuge (3 613 m). During the ascent to the refuge, the patient felt very tired, but he did not complain of headache; during workshops on fixed ropes, the HR monitor recorded a maximum HR of 175 bpm (101% of his theoretical maximal HR).

Day 4: Workshop around Cosmiques refuge (3 613 m). The patient reported to Dr. A that he suffered from insomnia, and throbbing occipital headaches during the whole night. At 2 a.m., he took 1 g of paracetamol, without relief; later he took 100 mg of ketoprofen and felt a little better. In the morning, he had difficulty getting up and felt dizzy. His neighbor found him “a little gray”. The pulse oxygen saturation (SpO₂) was 77%. He reported that observation to Guide A and Dr. B.

At 7 a.m., at breakfast, Dr. C found him “puffy” (localized facial edema): the patient told him that he had a Hackett score of 6 (moderate AMS: 4 to 6, severe AMS: > 6), without giving him details.

* Corresponding author. Université Sorbonne Paris Nord, UFR, SMBH, 1 rue de Chablis, 93017, Bobigny, Cedex, France.

E-mail addresses: richalet@univ-paris13.fr (J.-P. Richalet), marianne.magnan@free.fr (M.-A. Magnan), alice.gavet@gmail.com (A. Gavet), doc.lafere@proximus.be (P. Lafère).

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Abbreviations

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| ENSA | National School of Skiing and Mountaineering |
| AMS | acute mountain sickness |
| HR | heart rate |
| HAPE | high altitude pulmonary edema |
| HACE | high altitude cerebral edema |
| CT | computed tomography |
| CRP | C-reactive protein |
| BNP | brain natriuretic peptide |
| CPK | creatinine kinase |
| ASAT | aspartate aminotransferase |
| ALAT | alanine aminotransferase |
| SpO ₂ | pulse oxygen saturation |

At 7:30 a.m., the patient confided to Guide B that he took 2 g of paracetamol and that he had difficulty going down the stairs of the refuge without losing his balance. The patient told Dr. B that he has not urinated since 2:40 p.m. the day before and told Guide A that he took 3 g and not 2 g of paracetamol. Worried about the patient's symptoms, Dr. A checked his SpO₂. It was 95%, while it was 88% and 87% in two other participants without AMS symptom. Although his SpO₂ was reassuring, considering his symptoms, Guide B and Dr. A decided not to leave the patient alone at the hut without medical supervision and to make him walk down slowly to the base camp located at 3 450 m, (only 200 m below the refuge), to join the whole team and keep an eye on him. According to Guide B's advice, the patient prepared to leave the refuge, but struggled to put on his crampons. Finally, he walked down to join the group at the base camp, accompanied by a guide.

At 8:30 a.m., at base camp, he remained exhausted, seated on his bag. He told Dr. B that he had a bad headache and that "this was hell". When asked about possible respiratory signs, he replied that he was coughing a little and that he was short of breath. However, he had no obvious difficulty breathing or speaking. He was given 250 mg of acetazolamide and was told not to exercise and to remain under medical supervision.

At 10 a.m., two trainees found him exhausted, sitting on the snow and holding his head between his hands. They asked him how he felt. He did not answer, despite several requests. He was hungry and ate an energy bar. Sometime later, he coughed some blood.

At 10:05 a.m., faced with these signs, which were interpreted as the onset of high-altitude pulmonary edema (HAPE), as well as with the decreased level of consciousness (the patient fell on his side while seated), the trainees, in the absence of supervisors, decided to put the patient in the portable hyperbaric chamber (CERTEC bag) available at base camp for rescue training. The patient had to be reminded to remove his crampons and needed help getting into the bag. No drug was given.

After 15 min in the bag, the patient's state of consciousness improved, and it was possible to communicate with him again. However, he did not remember being installed in the bag and asked what happened.

Considering the clinical status of the patient and his obvious inability to ascend by his own means back to the refuge, Dr. A called the mountain rescue for evacuation. The patient stayed another 30 min in the bag. Then he was installed on a stretcher and was given 100% O₂. His condition improved.

At 11:30 a.m., the patient was evacuated at Sallanches hospital (550 m) after a 15 min flight for suspected high altitude cerebral edema (HACE) - with loss of consciousness and previous severe AMS, possibly with a HAPE component with hemoptysis. At the arrival, the patient showed normal cardiac, pulmonary and neurological (Glasgow coma scale = 15 out of 15 points) clinical examination. Resumption of diuresis was spontaneous (after 24 h of stopping), with very clear urine. There was no more headache.

At 1 p.m., a chest X-ray only revealed a slight hilar overload

predominantly on the left lung, a slight infiltrate in the right lower and middle lobes, and maybe fullness of pulmonary trunk, as well as a tracheal narrowing. No obvious sign of alveolar edema was found (Fig. 1).

Laboratory tests (blood gases, CRP, BNP, D-dimers, CPK, Troponin I, ASAT, ALAT, Gamma GT) were normal.

At 1:30 p.m., the patient reported to the emergency doctor "to have had blackouts" during the last few hours and suggested having a brain computed tomography (CT) scan for suspected HACE. After hesitation (because the neurological examination was normal), a CT scan was finally performed. An intravenous infusion was started, initially planned with 5% glucose, it was finally done with physiological saline (at the request of the patient). The patient asked for corticosteroids, but they were not prescribed. A prescription for codeine paracetamol (500/30 mg) was made, but the patient refused (due to the potential respiratory inhibitory effects of codeine; however, he showed no signs of respiratory failure). The CT scan showed minor changes compatible with "slight cerebral edema" (Fig. 2). No bleeding or ischemic injury was observed. The neurosurgeon reaffirmed that corticosteroids were not necessary. Following the results of the scan, the doctor offered 48 h of surveillance in the hospital, but the patient decided to leave against medical advice at 3:30 p.m.

Day 5: Chamonix. The patient joined the rest of the group to take the written exam at the end of the training course. His condition appeared to be quite normal. The patient obtained the best score of the group on the exam: 19/20!

Consultation

On day 5, Dr. C interviewed the patient to establish his medical history since this had not been done beforehand.

The patient is a 46-year-old anesthesiologist. In his medical history, obesity at 150 kg until 2015 was treated by bariatric surgery (sleeve gastrectomy). His current weight is 90 kg and his body mass index of 26. Currently, on sick leave (since November 3, 2016) he has a monthly psychological follow-up for burnout. He takes hydroxyzine occasionally (on average 1 to 2 times a week), melatonin for frequent insomnia or sometimes zopiclone: these treatments were stopped one week before the course (May 21st), without any side effects. However, prolonged effects after stopping these treatments on sleep quality cannot be excluded and could partly explain the fatigue and insomnia during the training session at altitude.



Fig. 1. Chest x-ray (Day 4, 1 p.m.). Slight hilar overload predominant on the left lung without sign of edema or infection. Courtesy: Hôpitaux du Pays du Mont-Blanc.



Fig. 2. Brain Computer Tomography scan (Day 4, 2 p.m.). Moderate reduction in the differentiation between white matter and the cerebral cortex, with reduction in the amplitude of the cerebral furrows that suggests moderate cerebral edema. Courtesy: Hôpitaux du Pays du Mont-Blanc.

The patient was in rather poor physical condition due to little training in the past six months. In 2016, he did several mountain climbs, including Mont-Blanc (4 807 m), without any problem, with several nights spent at Goûter (3 835 m) or Cosmiques (3 613 m) refuges. On Feb 2nd, 2017, he performed a hypoxia exercise test, which turned out to be normal. After the training session at altitude, an informal debriefing between the doctors and guides in charge of the group considered that the patient was a “humanly complicated” character.

Outcome

On day 5, late afternoon, the patient returned home after receiving safety advice for his journey by car. On day 9, he felt tired, with no other particular sign. On August 17th, 2017 (Day 78), his brain Magnetic Resonance Imaging was strictly normal. In October 2017, he climbed Aiguille de Rochefort (4 001 m) on acetazolamide (2 × 125 mg/d) without any problem.

Discussion

The presence of a group of medical experts at high altitude is rare and the occurrence of a serious altitude-related medical event in such a group is even rarer. Admittedly, the problem of “How a doctor should take care of a patient-doctor” has often been dealt with in the medical literature.^{3–5} Likewise, the role of an expedition doctor has been well defined in various journals.^{6–8} However the presence of a “supervising doctor” within a group of “exposed doctors” has, to our knowledge, never been addressed.

- *Effect of the “expert group”.* The group consisted of 14 physicians who had mountaineering experience, including 3 high-altitude specialists, and 3 guides with experience in high-altitude expeditions. The group had not appointed a “medical supervising officer” for the group. There was no specific management of the “patient-doctor” by a supervising doctor. The medical information was delivered in a piecemeal fashion to several members of the group, without a summary allowing a protocolization of the medical decision, whereas there exist several clinical scores for high

altitude pathology that can help decision-making such as Hackett score, Environmental Symptoms Questionnaire, Lake Louise Score.⁹ At 7:30 a.m. on day 4, such a clinical score could have been calculated and would have led to the diagnosis of severe AMS, which would have required appropriate management, or even evacuation. All (doctors and guides) relied on the decision of the other without one of them asserting himself in a leadership position and analysis. No supervisor took the initiative to bring together all the supervisors (guides and doctors) to discuss the case.

We propose to introduce the term “expert group syndrome” since this situation is unique where all subjects are “experts” for an illness due to an environmental condition that can affect each of them.

- *Marginalization of the patient from the group.* Due to challenging interpersonal communication, the patient's clinical condition was not taken seriously. The patient presented a high intellectual level, but he did not integrate well into the group. Several members of the group (supervisors and trainees) were skeptical about the authenticity of the severity of the symptoms experienced by the patient during the workshops at high altitudes.
- *Incorrect diagnoses.* The diagnosis of AMS was clearly made by all guides and supervising doctors. However, the degree of severity was not clearly established because of the above-mentioned factors. In the refuge, the measurement of a SpO₂ at 95% was clearly reassuring, validating a decision of non-evacuation. Probably, the personality of the subject blurred the decision. Later on, when signs of possible HAPE/HACE were clear, the decision of evacuation was rapidly taken, given the facility of helicopter rescue a few minutes from the nearest hospital. The presence of blood in what may have been vomiting and not hemoptysis at base camp on day 4 led to the possible diagnosis of HAPE, but there was no dyspnea at rest, the cough being common when exercising at high altitude. However, those who took care of the patient were unaware of his history of gastrectomy. Bloody sputum was perhaps due to gastroesophageal irritation linked to efforts to vomit. Hilar overload at chest X-ray could suggest slight pulmonary hypertension that had not yet resulted in frank alveolar edema. The episodes of headaches, drunkenness, disorientation, and obtundation, behavioral changes in favor of HACE were concealed. The medical history of the patient was not available before the pathological events that could have been interesting to consider: 1) no evident susceptibility for high altitude diseases, as suggested by no history of severe AMS/HAPE/HACE in previous climbs to high altitude, good response to hypoxia evidenced by a hypoxia exercise test¹⁰; 2) incomplete withdrawal from psychotropic drugs regularly taken by the patient might have contributed to the pathological events observed; 3) intense exercise in an unfit subject the day before may have favored the onset of severe mountain sickness. However, the very rapid management of the patient (presence of specialist doctors, a portable hyperbaric chamber, and a rapid helicopter evacuation) as soon as the symptoms worsened allowed rapid resolution without sequels.
- *Hospital care was poorly accepted by the patient.* Failure to consider his advice as an anesthesiologist and his systematic disagreement over prescriptions led him to leave the hospital against medical advice. Fortunately, the outcome was favorable.

Conclusion

The combination of a lack of designation of a supervising doctor responsible for the health of the group (of doctors) and the challenging patient's personality led to the absence of coordinated management and to an evolution of the symptoms towards severe AMS or even the onset of HACE. The absence of an available medical history did not allow the events to be placed in the clinical and psychological context of the patient. This observation also highlights the difficulty for a doctor to be treated by another doctor, especially if he claims the same specialty and equivalent competence. Optimal management of a group of doctors

exposed to a stressful environment necessitates the designation of a supervising medical officer in charge of the medical issues within the group, and a couple of supervising persons (doctor and guide) responsible for the general management and safety of the group. Submission and checking of confidential medical forms may also help prevent and/or manage pathological events. Assignment of group managers in identifying marginalizing behaviors could help mitigate team dynamic issues.

Submission statement

This article has not been published previously and it is not under consideration for publication. This publication is approved by all authors and by the responsible authorities where the work was carried out. After accepted, this article will not be published elsewhere including electronically in the same form, in English or any other language, without the written consent of the copyright-holder.

Authors' contribution

JPR, MAM, AG, and PL made the observations. JPR, MAM, AG, and PL participated in the writing of the article, its revision, and approval of its final version.

Ethical approval statement

This case study was conducted in accordance with Declaration of Helsinki.

Consent for publication

The patient gave his written informed consent for the publication of this case report.

Conflict of interest

The authors declare that there is no conflict of interest.

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