Increased choroidal thickness in patient with high-altitude retinopathy

Kyoko Hirukawa-Nakayama1, Akito Hirakarta1, Kaoru Tomita1,2, Tomoyuki Hiraoka1, Makoto Inoue1

We report a case of high-altitude retinopathy with increased choroidal thickness detected by spectral-domain optical coherence tomography (SD-OCT). A 36-year-old Japanese man developed an acute vision decrease in his left eye after he had trekked at an altitude of 4600 m in Tibet for 1 week. His visual acuity was 20/20 OD and 20/200 OS with refractive errors of −0.25 diopters (D) OD and −0.50 D OS 3 weeks after the onset of the visual decrease. Funduscopic examination revealed multiple intraretinal hemorrhages bilaterally and a macular hemorrhage in the left eye. SD-OCT showed that the thickness of choroidal layer at the fovea was 530 µm OD and 490 µm OS which is thicker than that in normal subjects of approximately 300 µm. We suggest that the increase in the retinal blood flow under hypoxic conditions may be associated with an increase in the choroidal blood flow resulting in an increase in choroidal thickness.

Key words: Choroidal thickness, enhanced depth imaging, high-altitude retinopathy, optical coherence tomography

High-altitude illness is characterized by acute mountain sickness, high-altitude retinopathy (HAR), high-altitude cerebral edema (HACE), and high-altitude pulmonary edema. The ocular signs of HAR are dilated retinal veins and arteries, diffuse or punctate pre-retinal hemorrhages usually located peri-circularly but occasionally in the macula, vitreous hemorrhages, papillary hemorrhages, peripapillary hyperemia, and papilledema. Fluorescein angiography shows no leakage, and the retinal hemorrhages are located superficially. The development of HAR is the first sign of HACE which can progress to death. We describe a patient with HAR whose choroidal thickness determined by spectral-domain optical coherence tomography (SD-OCT) was thicker than normal.

Case Report

A 36-year-old Japanese man was referred to us for the evaluation of bilateral retinal hemorrhages. He had been a healthy adult without any medical history. He developed an acute vision decrease in his left eye, pain in his right chest area, and headache after he had trekked at an altitude of 4600 m in Tibet for 1 week. Because of the illness, he descended 3 days later, and he felt better at that time but the visual impairment remained.

Our examination showed that his visual acuity was 20/20 OD and 20/200 OS with refractive errors of −0.25 diopters (D) OD and −0.50 D OS measured 3 weeks after the onset of the visual decrease. Funduscopic examination revealed multiple intraretinal hemorrhages bilaterally and a macular hemorrhage in the left eye [Fig. 1]. SD-OCT (Spectralis, Heidelberg Engineering, Heidelberg, Germany) showed that the macular hemorrhage was in the superficial layer of the retina beneath the inner limiting membrane of the left eye [Fig. 2]. The SD-OCT image shown was the average of 100 images. The thickness of the choroidal layer at the fovea was 530 µm OD and 490 µm OS which was thicker than the mean subfoveal choroidal thickness in normal subjects of approximately 300 µm in the enhanced depth images obtained by Spectralis SD-OCT. Most recent studies report that the average subfoveal choroidal thickness is 287 µm in Caucasians of an average age of 50.4 years and 272.6 µm in the Japanese of an average age of 30.5 years obtained by the enhanced depth imaging of the Spectralis SD-OCT.

Discussion

Individuals with acute mountain sickness present with lethargy, nausea, headache, insomnia, anorexia, and disorientation. The proposed mechanism for the symptoms of acute mountain sickness is respiratory alkalosis from hyperventilation and increased cerebral blood flow. In HACE, there is a breakdown of the blood–brain barrier which can lead to the edema and hemorrhage in the brain. HAR is relatively benign and the hemorrhage usually resolves spontaneously. However, HACE can lead to long-lasting severe neurological and psychiatric disorders and even death in some cases. Wiedman and Tabin examined 40 climbers who had ascended to altitudes of over 4870 m whether they developed signs of HAR, symptoms of acute mountain sickness, and clinically signs of HACE. All

Figure 1: Fundus photographs at the first visit of a patient with high-altitude retinopathy. Fundus photograph of the right eye (a) and the left eye (b) showing multiple intraretinal hemorrhages and a macular hemorrhage in the left eye.
patients who had HACE also had HAR. Thus, they concluded that when advanced HAR is recognized, treatment should be initiated for HACE with oxygen, steroids, or diuretics, and immediate descent to prevent further progression of HACE.

A pronounced increase in retinal blood flow in mountaineers with retinal hemorrhage and dilated epipapillary network has been detected with Heidelberg retina flowmeter after acute hypoxic stress at high altitudes. The increase in retinal blood flow and cerebral blood flow under hypoxic conditions may also be associated with an increase in choroidal blood flow resulting in an increase in choroidal thickness. The pathogenesis of the increased choroidal thickness may be similar to that of HACE, namely a breakdown of the blood–brain barrier and edema.

It is difficult to draw strong conclusions from a single case; however, we suggest that measurements of the choroidal thickness may be useful in evaluating the status of HACE. Currently, data are not available from population-based studies on the normal values for the choroidal thickness of a large number of Caucasians or Asians. Further studies are needed to evaluate the choroidal thickness in mountaineers with acute mountain sickness.

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References