저나트륨혈증에 동반된 일과적 맥락막 두께 변화

Transient Choroidal Thickening Associated with Hyponatremia

강혜민

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Purpose: This study reports two cases of transient choroidal thickening accompanied by hyponatremia.

Case summary: (Case 1) A 51-year-old patient experienced hyponatremia associated with inappropriate vasopressin secretion complained of blurry vision of both eyes. The refractive error based on the spherical equivalent was +2.00 diopters in both eyes. The mean subfoveal choroidal thickness (SFCT) by spectral domain optical coherence tomography was 262.5 μm in the right eye and 250.5 μm in the left eye. The serum sodium level was 117 mEq/L. After correcting the hyponatremia, the serum sodium level was 138 mEq/L, and the hyperopic shift of refractive errors resolved to emmetropia. The mean SFCT was reduced to 244.5 μm in the right eye and 229.5 μm in the left eye. (Case 2) A 39-year-old patient with hyperosmolar hyperglycemic state complained of decreased vision in both eyes. The refractive error of each eye was -4.25 diopters in the right eye and -3.75 diopters in the left eye. The mean SFCT was 267.0 μm in the right eye, and 252.0 μm in the left eye. The serum sodium level was 124 mEq/L. After glycemic control, the refractive error was changed to -1.50 diopters in the right eye and -1.25 diopters in the left eye. The serum sodium level was 141 mEq/L, and the mean SFCT was reduced to 240.0 μm in the right eye and 233.0 μm in the left eye.

Conclusions: Both isotonic and hypertonic hyponatremia can lead to transient choroidal thickening.

Keywords: Choroid; Choroidal thickness; Hyponatremia

Introduction

Hyponatremia is the most common electrolyte disorder and is defined as a serum sodium concentration (Na^+) less than 135 mEq/L [1]. Hyponatremia can affect the sodium volume in the entire body, and a previously reported case showed that hyponatremia, after removal of the pituitary tumor, lead to transient refractive change [2]. The authors

speculated that hyponatremia caused an osmotic change in the aqueous humor with lens swelling [2].

Recently, we diagnosed two patients with hyponatremia with transient refractive changes. In these patients, choroidal thickness also changed transiently. Previous transient choroidal thickness changes in patients with hyponatremia have not been reported, and herein we present two cases.

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Case Report

Case 1

A 51-year-old patient visited the ophthalmology clinic with complaints of blurry vision in both eyes. He had a history of traumatic subarachnoid hemorrhage and hyponatremia associated with inappropriate vasopressin secretion (SIADH) for 5 months. Best-corrected visual acuity (BCVA) was 20/20 in both eyes, based on the Snellen visual acuity chart. The refractive error by spherical equivalent was +2.00 diopters in the right eye and +1.75 in the left eye. Slit lamp examination showed no remarkable findings in the anterior segment. A detailed fundus examination after dilation showed no remarkable findings in either eye. The foveal contour and photoreceptor ellipsoid zone were also well-preserved by spectral domain optical coherence tomography (SD OCT, Spectralis, Heidelberg Engineering, Heidelberg, Germany). Choroidal thickness was defined as the distance from the outer border of the hyperreflective line that corresponded to the retinal pigment epithelium (RPE) and was perpendicular to the choriocleral interface. Digital calipers, provided by the Heidelberg Spectralis OCT software, were used. To measure subfoveal choroidal thickness (SFCT), at least two good-quality horizontal and vertical scans across the fovea were obtained for each eye. Additionally, 6-radial macular scans were obtained in enhanced-depth imaging (EDI)

mode. Using digital calipers provided by the Heidelberg Spectralis software, the choroidal thickness was measured at the subfoveal region in each trans-sectional image horizontally and vertically and then averaged. The mean SFCT was 262.5 μm in the right eye and 250.5 μm in the left eye. At the time, the serum sodium level was 117 mEq/L, and the blood pressure was 123 mmHg systolic and 76 mmHg diastolic. After correction of hyponatremia, serum sodium level was 138 mEq/L (Table 1), and blood pressure was 120 mmHg systolic and 73 mmHg diastolic. The hyperopic shift resolved to emmetropia, and the mean SFCT was reduced to 244.5 μm in the right eye and 229.5 μm in the left eye. The representative images are shown in Fig. 1.

Case 2

A 39-year old male patient was referred to the ophthalmology clinic with complaints of decreased vision for 2 weeks. He was in a hyperosmolar hyperglycemic state, and serum sodium level was 124 mEq/L (Table 1). The random blood glucose was 664 mg/dL, and hemoglobin A1c was 10.1%. Blood pressure was 134 mmHg systolic and 81 mmHg diastolic. The BCVA was 20/25 in both eyes, with a refractive error of -4.25 diopters in the right eye and -3.75 in the left eye. Both anterior and posterior segments showed no remarkable findings in both eyes. SD OCT showed preserved

Table 1. Changes in serum electrolytes, refractive errors, and subfoveal choroidal thickness in a 51-year old male patient with syndrome of inappropriate vasopressin (ADH) secretion (SIADH) (patient 1) and a 39-year-old male patient with diabetes mellitus (patient 2)

	Patient 1		Patient 2	
	Baseline (11 AM)	After 3 weeks (10 AM)	Baseline (4 PM)	After 1 week (4 PM)
Na (mEq/L)	117	138	124	141
K (mEq/L)	4.5	4.4	3.1	3.4
Cl (mEq/L)	89	104	90	107
Glucose (mg/dL)	-	-	664	244
Refractive error (diopter)*				
Right eye	+2.00	0 (plano)	-4.25	-1.50
Left eye	+1.76	0 (plano)	-3.75	-1.25
Mean SFCT (μm)				
Right eye	262.5	244.5	267	240
Left eye	250.5	229.5	252	233

Na = sodium; K = potassium; Cl = chloride; SFCT = subfoveal choroidal thickness.

*Refractive error in spherical equivalent.

Figure 1. A 51-year-old patient visited the ophthalmology clinic with complaint of blurry vision in both eyes. He had history of traumatic sub-arachnoid hemorrhage and hyponatremia associated with syndrome of inappropriate vasopressin (ADH) secretion (SIADH) for 5 months. (A) Spectral-domain optical coherence tomography (SD OCT) showed the representative image of a horizontal scan of the right eye and (B) the left eye. The serum sodium level was 117 mEq/L. The mean subfoveal choroidal thickness (SFCT) was 262.5 μm in the right eye and 250.5 μm in the left eye. At the time, the serum sodium level was 117 mEq/L. Three weeks after, hyponatremia was corrected up to 138 mEq/L, and he reported improved vision. The uncorrected visual acuity was 20/20 based on the Snellen visual acuity chart in both eyes. The mean SFCT was reduced in both eyes: 244.5 μm in the right eye and 229.5 μm in the left eye. The representative images of the horizontal scan by SD OCT included (C) the right eye and (D) the left eye.

Figure 2. A 39-year old male patient was referred to the ophthalmology clinic for ophthalmologic evaluation associated with diabetic mellitus. He complained of decreased vision for 2 weeks. The serum glucose level was 664 and the serum sodium level was 124 mEq/L. The mean refractive error was -4.25 diopters in the right eye and -3.75 in the left eye. The mean subfoveal choroidal thickness (SFCT) was 267.0 μm in the right eye and 252.0 μm in the left eye. The representative image of the horizontal scan by spectral-domain optical coherence tomography (SD OCT) included (A) the right eye and (B) the left eye. The patient was admitted for glycemic control; 1 week later, serum glucose level was 244, and serum sodium level was 141 mEq/L at the time of ophthalmologic evaluation. At the time of the second visit, the best-corrected visual acuity (BCVA) was maintained, but the refractive error had changed and was -1.50 diopters in the right eye and -1.25 diopters in the left eye. The mean SFCT was reduced to 240.0 μm in the right eye and 233.0 μm in the left eye. The representative image of the horizontal scan by SD OCT included (C) the right eye and (D) the left eye.

foveal contour with intact ellipsoid zone in both eyes. The mean SFCT of each eye was obtained as described in case 1. The mean SFCT was 267.0 μm in the right eye and 252.0 μm in the left eye. BCVA was maintained one week later, but refractive error changed to -1.50 diopters in the right eye and -1.25 diopters in the left eye. With glycemic control, the serum sodium level was reduced to 141 mEq/L (Table 1). Blood pressure was 130 mmHg systolic and 80 mmHg diastolic. Foveal microstructures were also maintained in both eyes based on SD OCT, and the mean SFCT was reduced to 240.0 μm in the right eye and 233.0 μm in the left eye. The representative images are shown in Fig. 2.

Discussion

In our two case studies, electrolyte imbalance, especially hyponatremia, affected choroidal thickness. The mean SFCT was thicker during hyponatremia and then was reduced after correction of hyponatremia. Although diurnal variation might be associated with choroidal changes [3], the mean SFCT in each eye was measured at the same visit due to patient preference. Blood pressure was also not significantly changed at the time of the visit. Thus, we could speculate that hyponatremia may be associated with transient choroidal thickening.

For case 1, the patient can be classified as isotonic hyponatremia. In SIADH, direct ADH secretion stimulated by glycine may prolong water retention, leading to hyponatremia [1]. In this case, generalized retention of water was the likely cause of choroidal thickening, which is a reflection of choroidal blood volume and increased blood volume, especially plasma volume, which can lead to choroidal thickening.

For case 2, the patient can be classified with hypertonic hyponatremia. Hypertonic hyponatremia occurs when it is difficult for an excess of extracellular solutes, other than sodium salts, to enter into the cells [1]. Increased extracellular solutes result in an osmotic shift of intracellular water into the extracellular compartment, and this fluid movement dilutes the extracellular sodium, leading to hyponatremia. Hyperglycemia is the prototype of hypertonic hyponatremia. This patient was admitted due to hyperglycemia and had a serum glucose level was 664 mg/L at the time of admission. In this patient, extracellular fluid movement lead to increased blood plasma volume, causing increased choroidal

blood volume and subsequent choroidal thickening. After glycemic control, both refractive error and choroidal thickness returned to presumed baseline values.

Although it seems for both of these cases that hyponatremia was associated with transient choroidal thickening, the refractive error changes were different with each other. A transient hyperopic shift occurred in case 1, whereas a transient myopic shift occurred in case 2. Previous studies on transient refractive changes have reported results that vary from myopic shift to hyperopic shift [2,4-9]. Even hyperglycemia and glycemic control can induce changes in refractive errors [6-9]. Both type 1 and type 2 diabetes mellitus can affect crystalline lens properties, such as thickness, shape, and equivalent refractive index of the human crystalline lens, leading to differences in refractive errors in these patients [10]. Although the exact pathophysiology of transient changes in refractive errors has not yet been elucidated, various structural changes, such as position or refraction of lens; ciliary body edema, which can case related zonules; and anterior chamber depth are possible factors associated with transient refractive error changes. Recently, one study investigated the ocular components responsible for transient refractive changes in diabetic patients [11]. The authors suggested that changes in the gradients of the refractive index lens within the lens are the key factors that affect lens power, leading to transient refractive changes [11]. We suspected that the lens properties were different with each other of our two cases, which caused the different transient refractive changes. However, due to the retrospective manner of this case report, we were unable to collect information about factors such as anterior chamber depth and lens thickness, which could confirm the lens status. The primary focus of this case report was the hyperopic shift associated with hyponatremia; additional studies are needed to investigate this shift, and larger studies that assess lens status information should be performed to clarify the differences in refractive changes.

This study reports cases where hyponatremia may have affected the choroidal thickness Hyponatremia can induce blood volume expansion, leading to transient choroidal thickening, which returned to baseline values after correction of hyponatremia. Additional clinical impacts of choroidal thickness changes that are associated with hyponatremia should be investigated.

Conflicts of Interest

The author declares no conflicts of interest relevant to this article.

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