High Salt Diet Induced the Rapid Myopic Shift of Cataract Formation

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Abstract: Purpose: To report a 24 young female with hypernatremia and cataract formation with high high myopic shift in the left eye which happened suddenly within one month. Methods: Case report. Results: The young female complained about blurred vision for one month in this year. After series of studies, severe nuclear sclerosis (Grade 4) of lens of left eye was found under the slit lamp examination. The myopic shift increased about 10 D (from zero to -10D) within one month suddenly. Her bare visual acuity had decreased to 6/60. Thus, we had arranged the phacoemulsification combined with intraocular lens insertion at once. At the beginning of cataract surgery, we withdraw little anterior aqueous humor fluid for analysis. Sodium in the aqueous revealed 103 mmol/kg H2O which is apparently lower than the normal range. At the same time, we checked the serum sodium and hypernatremia (Na+ =151 mEq/L) was found. The mean blood pressure was about 150/95 mmHg and the patient had severe thirsty sensation. Because of the diagnosis of essential hypertension, she was suggested to receive further medical treatment. Conclusion: The causal relationship between high salt intake and high blood in established now. Besides, hypernatremia may also combine with the decreased sodium level in anterior aqueous humor. The sodium shifted into the lens would induce the osmotic swelling with lens fiber damage. The hyper-osmotic pressure may accelerate the formation of cataract. Because sodium in food was often derived from soy sauce, monosodium glutamate and miso soup in Taiwan, to inform and educate the public become very important. To our knowledge, the very young age and the rapid change of refractive error within one month in our case had never been reported in the world.


Keywords: High Salt Diet, Cataract, Mopic shift

1. Introduction
Cataract induced related loss of vision affected many adults today and become a health burden to many nations in the world (1). It is well believed that the patients with cataract will increase to several million. In USA, cataract surgery was estimated to take up about 12% of medical budget (2). In Taiwan, nearly one hundred thousand people receive the cataract replacement with synthetic lenses in each year. There are several factors contributing to cataract including congenital, age-related, trauma, UV light (especially the UV-B), cigarette, infection, poor nutrition, diabetes, oxidative stress, nutrition, occupational, genetic factor (3,4,5,6,7,8,9) and even psychotropic agents (including phenothiazines and atypical antipsychotics) (10). However, diet may also play a important factor in the formation of cataract (11,12). High levels of dietary sodium (consumed as common salt, or sodium chloride) are associated with raised blood pressure and adverse cardiovascular health. Sodium intakes around the world in excess of physiological need (i.e. 10-20 mmol/day) including Spain, Cameroon, Ghana, Samoa, Tanzania, Venezuela, and Uganda. Most adult populations have mean sodium intakes > 10 mmol/day and for many (particularly the Asian countries including ROC(Taiwan)) mean intakes are > 200 mmol/day (13). The relationship between cataract, hypernatremia, and hypertension was mentioned by literature (14). In this article, we will report a patient with hypernatremia and rapid progression of cataract formation within one month.

2. Case report
A 24-year-old young female suffered from suddenly blurred vision of left eye within one month
aqueous humor was analyzed, and relatively lower
the bag. At last, we sutured the incisional wound by
enlarged, we inserted the intraocular lens (AMO) into
the residual cortex. Then the corneal wound was
hard nucleus of cataract were removed, we aspirated
phacoemulsification was done step by step. After the
capsule. Then hydro-dissection, deeper central
forceps to create the round opening on the anterior
capsulorhexis (CCC) was performed by the CCC
anterior chamber space, continuous curvilinear
for series of biochemical analysis. Followed by
Little aqueous humor (about 0.3CC) was withdrew
used to enter the anterior chamber on the corneal side.

3. Discussion

In 1990, the World Health Organization (WHO)
reported that for 41.8 % of the 38 million blind
people, approximately 16 million, the cause of
blindness is due to cataract. Until 2020, the number
of patients with blindness caused by cataract will
reach nearly 40 million. It means that the amount of
patients with cataract need the operation will increase
to threefold (16). There are many impending
factors contributing to cataract formation in previous
studies. Recently the hypernatremia combined with
hypertension was heatedly discussed. An increase in
the sodium intakes of 100 mmol/day (equivalent to
about 6 g/day) may raise systolic blood by 6 mmHg.
This result revealed a correction between sodium
intake and blood pressure (17). The DASH-
Sodium Trial also demonstrated that sodium intake
may influence the blood pressure, and that the lower
sodium intake is associated with the lower pressure
(18).

Even though not every patient with
hypernatremia will develop into cataracts (27). We
must pay attention to the possibility and their
relationship carefully. For example, Mathur et al. had
reported that high serum sodium levels was
significantly found in the patients (age > 50 years old)
with cataract especially in the nuclear and mixed
(cortical and nuclear) type (12). Their results are
consistent with our report which showed nuclear
sclerosis (Grade 4) and severe myopic shift (nearly
10 D change). However, the patient in our case is
younger (only 24 years old). To our knowledge, the
very young age and the rapid change of refractive
error within one month in our case had never been
reported in the world.

Clayton et al revealed that alternation in cation
concentration of aqueous humor which is attributed
to alternations in serum cation concentration, can be
known as a risk factor for the cataract formation
(19). In lenses, when K+ is pumped into the lens,
Na+ is pumped out, generating a chemical gradient,
and the mechanism, while regulating water content,
allows the lens to act as a osmometer and contributes
to the transparency of the lens (20). In cataratous
condition, influx of Na+ in the lens may attracts water
ions, increase the impact on the osmotic balance in
the lens environment (21). Due to the swelling lens,
the myopic shit will be noted. In the meanwhile, we
would found out the lower sodium level in the

Na+ level (103 mmol/kg H2O) was found (Normal
range is about 163 mmol/kg H2O) (15). One week
later, the bare visual acuity of her left eye had
returned to 6/6 and normal depth of anterior chamber
(ACD) was found.
anterior chamber fluid in our patient. Besides, some reports indicated that accumulation of Na$^+$ would lead to the impaired permeability of lens membrane and interfere with the synthesis of crystalline or soluble protein resulting in cataract formation (22).

The relation between diet especially in sodium intake and hypertension are relatively well established which indicates that the excessive intake are related to high blood pressure. For example, Miura et al. reported that the systolic blood pressure were higher in excessive salt intake group (especially in men) (23). Mirsamadi et al. reported that the positive and significant correlation between the excessive sodium intake and cataract development (24). In general, the main sources of natural sodium in the daily diet were fish, egg, fruit, legume, milk and vegetables, constituting 60% of the total amount. In Taiwan, salt added at home (in cooking and at the table) and soy sauce were the largest courses. At the same time, the excessive sodium from miso soup still can not be neglected. In eastern population (some Asian countries) including China, Korea, and Japan, 53% may come from cooking, 16% from soy sauce and 6% from monosodium glutamate (MGS) (16, 23, 25). Choong et al. found that preference and intake frequency of high sodium foods and dishes among Malaysian subjects (26). Tian et al. also had concluded that more educated men and women had lower intakes of salt and soy sauce, and higher intake of MGS. They also found that some Chinese women like the soy sauce very much (16). Besides, individual food habits are influenced by a host of social, cultural and economic factors. In European and Northern American countries, the major source of dietary sodium is processed foods. For example, cereals and baked food goods were the single largest contributor to dietary sodium intake in UK. Thus, how to educate individuals the importance of dietary salt in various foods for representing etiologic risk factors of cataract development becomes the serious problem today.

In conclusion, epidemiologic and interventional trials have been shown that an excessive intake of sodium cause hypertension and the development of cataract. Until now, there are no recognized treatments to reverse lens cataract once they have begun to form. Thus it is very important to assess intervention strategies that could prevent or delay lens cataract formation at an early stage of their development. Therefore, how to restrict excessive intake of sodium in daily diet is very important. It may not only decrease the incidence of cardiovascular disorders, but also prevent from the possibility of cataract formation.

Figure 1. No apparent dislocation or subluxation and zonular dehiscence was found by Ultrasound Bio-Microscopy (UBM)

Figure 2. Slit-Lamp biomicroscopy showed severe nuclear sclerosis (Grade 4) of cataract in the left eye

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