Down syndrome with asymptomatic neuroglial cyst: A case report and review of the literature

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Introduction

The central nervous system (CNS) abnormalities related to Down syndrome (DS, trisomy 21) is associated with neuroanatomical abnormalities, including choroid plexus cysts and various types of brain tumors. Trisomy 21 is associated with oncogenic factor, especially in brain tumor. The brain of DS patients had a smaller volume of gray and white matter and an unbalanced cerebellum volume, indicating a smaller volume overall than normal. We report a case of a DS male patient who had an incidentally discovered neuroglial cyst in left cerebellar vermis. He visited our hospital with gait disturbance and fatigue. But, the neurologic exam was normal. To the best of our knowledge, this is the first reported case of a neuroglial cyst in a trisomy 21 patient. As the developmental mechanisms of a cyst and the choroid plexus are related, more research is needed.

Key words: Central nervous system cysts, Cysts, Down syndrome, Neuroglia.
Case

An 8-year-old male visited Soonchunhyang University Bucheon Hospital complaining of gait disturbance and fatigue. His medical history included birth at 32 weeks of gestation with a birth weight of 2.7 kg via normal spontaneous vaginal delivery; his birth followed that of two previous siblings with no evident abnormalities. He was diagnosed with DS at birth (47, XY, +21) (Fig. 1), with no family history of DS. At the age of 7, the patient underwent an operation to treat a persistent patent ductus arteriosus. The patient demonstrated common physical traits associated with DS including a broad flat face, a flat nasal bridge, an upturned nose, a small arched palate, and a short neck. All of his anthropometric measurements (height, weight, and head circumference) were below the third percentile for age and sex, according to the Korean growth standard established in 2007 by the Korean Centers for Disease Control and Prevention [6].

Upon physical examination and interview, the patient’s parents said that the child’s gait was strange, but no gait disturbance was found. His mental status was alert, without dysarthria; on performing a cerebellar function test, the motor strength of his upper and lower extremities were found to be normal (5/5), as was his DTR grade (2/4). He reported normal muscle sensations. Heel-to-toe test and Romberg’s test were normal. On admission, all his vital signs were normal, and his complete blood differential counts were within normal ranges, as follows: white blood cells, 6,200/µL; hemoglobin, 13.5 g/dL; hematocrit, 39%; and platelet count 288,000/µL. Moreover, his aspartate aminotransferase and alanine aminotransferase levels were within normal ranges (34/34 IU/L). No electrolyte imbalance was evident and his sodium/potassium/chloride (Na/K/Cl) levels were 139/4.7/104 mmol/L. A thyroid function test revealed a thyroid-stimulating hormone level of 4.0 µIU/mL and a free thyroxine (T4) concentration of 1.25 ng/dL. Brain MRI revealed a neuroglial cyst approximately 1 cm in diameter in the left cerebellar vermis adjacent to the fourth ventricle. A developmental venous anomaly was evident in the left cerebellum (Fig. 2). He was discharged after observation, without any specific treatment.

Discussion

The brain of a child with DS develops differently from the brain of a neurotypical child [7]. Neurodevelopmental changes are evident in both the prenatal and early postnatal periods. Neurogenesis is disrupted and the numbers of cortical neurons

![Fig. 1. Identified trisomy 21 on chromosomal analysis.](image)

![Fig. 2. (A) Neuroglial cyst (arrow) of patient’s magnetic resonance image. (B) Developmental venous anomaly (arrow) in left cerebellum.](image)
decrease, triggering changes in myelination [8,9]. After about 4 months, the neurons exhibit enlarged dendrites, but these dendrites stop growing within the first year, and the neurons then appear atrophied compared with neurons in a typical brain at the same age [7]. The expression levels of various neurotrophic factors, including brain-derived neurotrophic factor (BDNF), fall during early development of the brain of patients with DS [10]. BDNF is a neurotrophin that plays a key role in neurogenesis and the maintenance of neuronal plasticity by binding specifically to tropomyosin-related kinase receptor B [11].

Brain tumors in patients with DS exhibit a specific distribution, and differ from those of the general population [12]. On autopsy, DS has been found to be associated with neuroanatomical abnormalities in the corpus callosum, ventricular hypertrophy, and malformations of the cerebellum, frontal lobe, temporal lobes, and brain stem [13,14]. In particular, choroid plexus cysts are associated with trisomy 21 [15]. Most studies exploring the association of choroid plexus cysts and chromosome aberrations have evaluated heterogeneous high-risk populations [16]. Such cysts are typically detected in the second trimester, presenting as sonolucent cysts associated with the lateral ventricles, demonstrating cyst diameters ranging between a few millimeters and 1-2 cm. These cysts may be echogenic because the cysts are surrounded by the choroid plexus [17].

A neuroglial cyst is a benign epithelial lesion that may develop anywhere in the neuraxis. Neuroglial cysts account for <1% of all intracranial cysts [18] and are more common in the occipital area than in the cerebral hemisphere. Intraparenchymal cysts are more common than extraparenchymal cysts. Such cysts are also termed gliopendymal cysts. Neuroglial cysts are derived from isolated embryonic neural tube elements; the cysts are round, soft, monocular, and contain a clear liquid similar to cerebrospinal fluid (CSF). The cysts are surrounded by ependymal cells or those of the choroid plexus [19]. Upon ultrasound examination, the cysts are found to resemble arachnoid cysts [20].

Neuroglial cysts vary in size and are non-enhancing, and abnormalities in the surrounding signal intensities are minimal to absent. Cranial computed tomography reveals uniformly hypodense lesions with no contrast enhancement. MRI reveals well-defined cysts that are isointense to the CSF on T1-weighted images and isointense or mildly hyperintense on both proton-density and T2-weighted images [21]. The cysts are benign and have smooth round borders. The origin of such cysts remains controversial, although it has been hypothesized that they develop during embryogenesis via sequestration of the developing neuroectoderm [22].

Abnormally developing brain areas may be conducive to cyst formation. It has also been proposed that the cysts originate via ectopic displacement of neural tube wall segments at the site of tela choroidea formation [23]. If this is the case, a cyst would be a congenital abnormality of the ventricular process [24]. These cysts may be asymptomatic for long periods, throughout the fetal period and into adulthood. Their clinical signs are attributable to associated anomalies, including callosal dysgenesis, neuronal heterotopia, and/or cortical dysplasia, or related malformation syndromes, like orofaciodigital syndromes, especially of types I and II, and Aicardi syndrome [25]. Sometimes, the cysts trigger symptoms such as headaches or epileptic seizures. The neurological defects associated with the cysts depend on the location and size of the lesion [26]. Some pediatric cases with gliopendymal cysts exhibit a loss of neurological function and intracranial hypertension, which are associated with in utero observations of abnormal brain development [27].

To the best of our knowledge, this is the first report of a neuroglial cyst in a patient with DS. As neuroglial cysts are covered with ependymal cells of the choroid plexus, further research on the development of neuroglial cysts in patients with DS is needed.

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References


