Letter to the Editor

Brain magnetic resonance imaging of Joubert syndrome: case presentation in a child

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A 16-year-old boy was admitted to our hospital due to sudden pale face and chest pain for half-an-hour. He could not express properly because of hypophrenia. Other examinations revealed congenital cataract in the right eye, as well as nystagmus and generalized hypotonia. He had signs of ataxia, and, though without deformity in any limb, was unable to complete the straight-line walking test. Five years ago, the boy was abandoned to a welfare home. The caretaker of the welfare home complained that the boy had several times of episodic hyperpnea, every 1–2 h, each lasting for about 10–40 s, during the night sleep. Ultrasonography of liver, cholecyst, pancreas, spleen, kidney and heart showed no abnormal findings. Electrocardiogram showed sinus arrhythmia. Magnetic resonance imaging (MRI) of the brain showed a cerebrospinal fluid line between the bilateral cerebellar hemispheres (*Figure 1A*), enlarged fourth ventricle with abnormality in shape (*Figure 1B*), and bilaterally elongated superior cerebellar peduncles with deep interpeduncular fossa (*Figure 1C*), as well as horizontally oriented cerebellar peduncles on sagittal T1 weighted image (*Figure 1D*).

Joubert syndrome (JS) was first described by Joubert in 1969 as an autosomal recessive inherited disorder with defective development of cerebellar vermis and brainstem (1). JS mostly occurs in male children. Hypotonia and ataxia are the most common characteristic signs of JS, and most of the children with JS have cognitive dysfunction (2). Other findings of JS include cystic kidney disease, retinal dystrophy, hepatic fibrosis, and polydactyly, colobomas (3). JS is characterized by the key imaging abnormality of the cerebellum and the brainstem, which is known as the "molar tooth sign" (MTS) (3). The MTS has been identified in a group of disorders termed JS and related disorders (JSRDs) that are associated with a number of systemic congenital abnormalities (4).

Saraiva *et al.* in 1992 have suggested the following diagnostic criteria for JS: vermis hypoplasia, developmental delay, hypotonia, abnormal breathing and/or abnormal eye movements. These reports confirmed the MTS as the fundamental diagnostic imaging attribute (2,4,5). MTS is a cerebellar vermis hypoplasia that resulted from an abnormally deep interpeduncular fossa, and thickened, elongated cerebellar peduncles (6). In addition, the fourth ventricle appears as a "bat-wing" (6). The partial or complete absence of cerebellar vermis results in the separation of bilateral cerebellar hemispheres at the midline, allowing fine-line cerebrospinal fluid. Both clinical and radiographic examination confirmed that the case had diagnostic criteria of JS.

Over the past several decades, increasing attention has been paid to the genetic basis of JS. In the year 2013 Romani *et al.* identified 21 causative genes (7). Moreover, in the year of 2017, Vilboux *et al.* claimed that there were more than 30 genes (*NPHP1*, *OFD1*, *TCTN2*, *TCTN3*, *TMEM138*, *TMEM216*, *TMEM231* and so on) associated with JS (8). Till now, more than 35 genes have been confirmed to be the cause of JS by mutating in an autosomal-recessive or X-linked manner (9). This suggests that there are more and more causative genes that need to be identified by innovative technologies. The rapid rate of genetic discoveries plays an important role in addressing the issue on genetic counseling and is expected to bridge the gap in the identification of potential targets for treating JS (7).

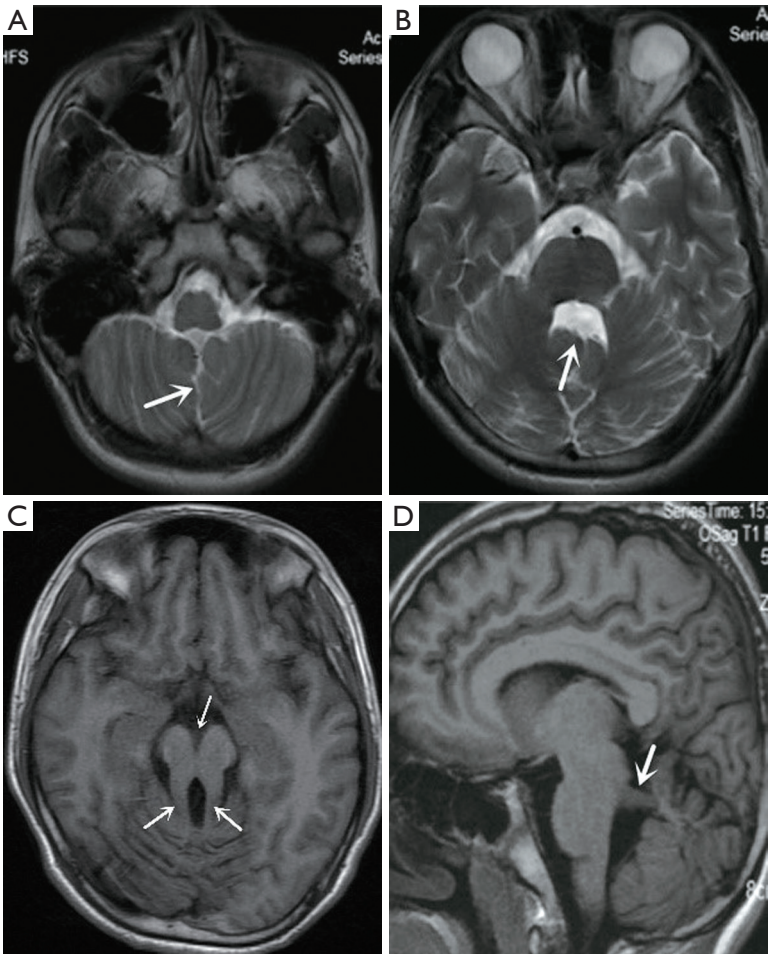

Figure 1 Brain magnetic resonance image of a child with Joubert syndrome. (A) A cerebrospinal fluid line (arrow), which is hyperintense on T2 weighted image, is observed between the bilateral cerebellar hemispheres; (B) the enlarged fourth ventricle appears as a "bat-wing" (arrow); (C) elongated bilateral superior cerebellar peduncles and deep interpeduncular fossa together constitute the "molar tooth sign" (arrows); (D) sagittal T1 weighted image shows the elongated and horizontally oriented superior cerebellar peduncles (arrow).

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and accompanying images.

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