

CEREBELLAR AGENESIS: TWO CASE REPORTS WITH REVIEW

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ABSTRACT

The content on which this review is based comprises of two patients which show marked deficiencies in the development of the cerebellum. For explanatory purpose, the two cases will be designated and referred to as patient 1 and patient 2. Cerebellar agenesis being an extremely rare condition involves complete absence of the cerebellum. The molecular basis and pathogenesis of this disease still remains unknown. Due to fewer number of cases, it is challenging and controversial to understand the degree of cerebellum development necessary to avoid deficits in motor and non motor functions in case of complete cerebellar agenesis. In this brief review of the literature on cerebellar agenesis, it should be borne in mind that reference will be made only to two definite cases of agenesis.

KEYWORDS: Cerebellum, Cerebellar Agenesis, Motor deficiency, Ataxia.

INTRODUCTION

Most reported cases are based on autopsy reports therefore a complete description of neurological findings in a living adult with cerebellar agenesis is almost non-existent (1-3). Combettes in 1831 was the first to describe Primary cerebellum agenesis, a rare condition marked by absence of the cerebellum. Prior to this study only eight cases have been reported so far, at an early age the degree of cerebellar dysfunction and development delay observed marks the clinical presentation of primary cerebellar agenesis (4). A condition defined by an incomplete or underdeveloped cerebellum Chiari malformation type IV is oftentimes diagnosed as primary cerebellum agenesis. Primary cerebellum agenesis is associated with severe developmental anomalies resulting in a high mortality rate (5). There is a debate in the literature as to whether a normal or near normal life is possible in case of complete CA. While supporters of one side of the debate say that such patients always have severe motor deficits (6) others believe the myth that they may not have any observable symptoms. Most cases with CA are diagnosed in the prenatal or early postnatal period and are associated with other central nervous system abnormalities (7-8).

CASE REPORT 1

A 24yr old patient was admitted in the hospital with inability to walk properly. During examination her mother revealed that it took 4years for her to stand properly, the neurological exam revealed that she was mentally sound (6). Finger to nose test- patient showed mild dysmetria. The patient showed moderately

reduced gait speed with muscle tone mildly increased, there was no focal paresis and the sensory system on evaluation showed no abnormalities. Following the CT scan the patient showed no cerebellar tissue and a lower posterior fossa density (7). There was a large cyst present on both the lateral side of the pons. In addition magnetic resonance angiography vascular characteristics consistent with complete cerebellar agenesis (3). The patient was thus diagnosed with Complete Cerebellar Agenesis.



Fig 1: The Sagittal MRI Marks A Definite Comparison Between Patient 1 And A Normal Individual Respectively, Patient 1 Reveals That The Posterior Fossa Density Is Filled With CSF And No Presence Of Cerebellum Is Seen. No Herniation Is Observed In The Hind Brain And Absence Of Hydrocephaly Is Seen. The Third And Fourth Ventricles Are In Proper Shape, The Medulla Oblongata And Pons Are Well Preserved And Attenuated With Straight Sinus And Tentorial Attachment Normal In Condition (17)

CASE REPORT 2

A 61-year-old male patient presenting with difficulty in walking and disturbed speech was presented in the hospital. He had a history of developmental delay, had not learned to read or write, and had not worked. He was severely dysarthric and ataxic. He had bilateral dysmetria, dysidiadochokinesia, and reduced arm and leg coordination. His muscle strength and tone was normal without any motor deficits with normal deep tendon reflexes and sensory system. He had congenital esotropia and strabismic amblyopia. His full scale intelligent quotient (IQ) level, as assessed using Kent E-G-Y Test and the Porteus Maze Test, was 35 showing that he had moderate mental retardation. He also had severe cognitive impairment (15/59) as tested by using Cognitive Status Schedule. We noted that deterioration of his neurological and mental status had started 1 year prior to his latest presentation to our hospital. Cranial MRI (1.5 T GE HDxt) showed only small residual cerebellar tissue corresponding to vermis and almost complete absence of the cerebellum. Brainstem and middle cerebellar peduncles were hypoplastic; posterior fossa was normal in size. Absent cerebellum resulted in a large cerebrospinal fluid (CSF) space representing a huge cisterna magna. Supratentorial structures were normal (Fig2) and (Fig 3c). Supratentorial white matter bundles were unaffected. Evaluation of three-dimensional (3D) T2-weighted sequences showed the absence of superior cerebellar and anterior and posterior inferior cerebellar arteries; while vertebral, basilar, and posterior cerebral arteries were normal (17).



Fig 2: T1-weighted Sagittal Images Show Absent Cerebellum, Small Residual Vermis (Arrows), Hypoplastic Brainstem, And Normal Supratentorial Anatomy

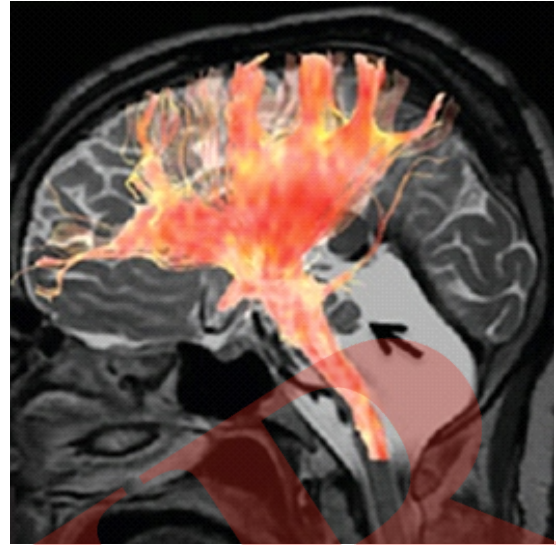


Fig 3: Diffusion Tensor Tractography, Superimposed On 3D Cube T2 Sagittal Image Shows That Brainstem Bundles Are Small And No Fibers Are Extending To Residual Cerebellum, While Supratentorial Bundles Are Unaffected

DISCUSSION

The role and necessity of cerebellum has always been a generalized idea but with researches on cerebellar function evolving rapidly many additional questions are getting prompted on a daily basis (08). In case of subtotal cerebellar damage is normal cerebellar function possible? Can another part take over if one part is damaged? (09) The development plasticity and functional compensation seen with the remaining brain tissue when cerebellar deficiency is arising very early during embryogenesis is remarkable (10). Only mild to moderate motor deficiency, ataxia dysarthria with mild mental impairment is seen in patient 1 having complete absence of cerebellum (11).

In patient 2, documented detailed neurologic, neuropsychiatric, and neuroimaging findings supported the view that a life without a cerebellum is abnormal, although such patients can have a near normal life expectancy and lead a simple life (12). Using diffusion tensor tractography, it was additionally shown that supratentorial white matter bundles were unaffected and that no fibers extended from the brainstem to either residual vermis or small cerebellar peduncles (13). A malformative or disruptive etiology may be responsible from Cerebellar agenesis. In primary cerebellar agenesis, there is a malformation of the developmental process; where in acquired cases, there is disruption of the cerebellum in the prenatal or perinatal period due to hemorrhage, ischemia, or other factors (14). Cerebellar agenesis with disruptive etiology is usually accompanied by additional brain abnormalities. Recently, mutation of Ptf1a gene, a key regulator of cerebellar neurogenesis,

has been reported in a case of agenesis of the cerebellum and of the pancreas. Thus patients like these will present with a variety of developmental, clinical, and mental abnormalities. Although they may lead a simple life, they may suffer various degrees of cognitive, intellectual, and fine motor skill problems (15-16). This patient in contrast to the first emphasizes mental, language, normal motor development as a major role of cerebellum whereas patient 1 supports the concept of extracerebellar motor system.

CONCLUSION

Even though cerebellum was absent in both the patients, the patients' body still carried out functions, the functions that should have been performed by the cerebellum was performed by some other extracerebellar motor system; thus making it reasonable why the patient started walking so late and showed delayed motor functions. We still consider cerebellum the primary organ responsible for equilibrium, body balance and posture maintenance but we cannot deny our brain's magnificent ability to perform functions of under developed or completely absent organs along with its own function. Not many cases have been reported so far thus making this case challenging and controversial to understand and make a complete prognosis.

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