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JOUBERT SYNDROME ASSOCIATED WITH COMPLETE AGENESIS OF THE CORPUS CALLOSUM IN AN 8-YEAR-OLD BOY: A RADIOLOGIC CASE REPORT

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ABSTRACT

Joubert syndrome is a congenital ciliopathy defined neuroradiologically by a characteristic malformation of the pontomesencephalic junction. When accompanied by complete agenesis of the corpus callosum, it produces a striking combination of infratentorial and supratentorial MRI signs. We report the imaging findings in an 8-year-old boy referred for brain magnetic resonance imaging because of clinically suspected macrocephaly. He had no motor or language delay and no history of seizures, although mild learning difficulties were reported. Renal evaluation was normal. Magnetic resonance imaging demonstrated complete absence of the corpus callosum, parallel and widely separated lateral ventricles with the racing-car configuration, lateral eversion of the frontal horns producing a bull's-horn appearance, colpocephaly, and widening of the interhemispheric fissure. At the pontomesencephalic junction, a deep interpeduncular fossa and thickened, elongated, horizontally oriented superior cerebellar peduncles, together with vermian hypoplasia, produced the characteristic molar tooth sign. The combined findings supported a Joubert spectrum disorder associated with complete callosal agenesis and underscored the value of MRI pattern recognition in a child with limited neurologic manifestations.

KEYWORDS

Joubert syndrome; agenesis of the corpus callosum; molar tooth sign; pediatric brain MRI; racing-car sign

MAIN ARTICLE

INTRODUCTION

Joubert syndrome comprises a clinically and genetically heterogeneous group of ciliopathies defined by a characteristic midbrain-hindbrain malformation on axial magnetic resonance imaging (MRI): the molar tooth sign [1-4]. This sign results from a deep interpeduncular fossa and thickened, elongated, horizontally oriented superior cerebellar peduncles, usually in association with hypoplasia or dysplasia of the cerebellar vermis [1,2]. Clinical expression varies and may include neonatal breathing dysregulation, abnormal eye movements, hypotonia, ataxia, developmental delay, or cognitive impairment [2-4].

Agenesis of the corpus callosum (ACC) may be complete or partial and may occur alone or as part of a broader malformative or genetic syndrome. Its typical imaging manifestations include parallel and widely separated lateral ventricles, colpocephaly, a high-riding third ventricle, the racing-car sign on axial images, and a bull's-horn or Viking-helmet configuration on coronal images [5,6]. The coexistence of a molar tooth malformation and complete ACC has been documented within the Joubert spectrum [7,8]. We describe the radiologic findings of this association in a school-aged boy with a paucisymptomatic clinical presentation.

CASE REPORT

An 8-year-old boy was referred for brain MRI because of clinically suspected macrocephaly. The increase in head size was the only reason for imaging. There was no history of delayed walking or delayed language acquisition, and no seizures had occurred. His family reported mild learning difficulties at school. Renal evaluation was unremarkable. No head-circumference measurement or molecular genetic result was available for inclusion in this report.

Brain MRI showed nonvisualization of the genu, body, splenium, and rostrum of the corpus callosum, consistent with complete ACC. The lateral ventricles were parallel and widely separated, producing the racing-car configuration on axial images. Lateral eversion of the frontal horns produced the bull's-horn appearance on coronal images. Colpocephaly, mild enlargement of the third and fourth ventricles, and widening of the interhemispheric fissure were also present.

Evaluation of the posterior fossa and pontomesencephalic junction demonstrated vermian hypoplasia, a deepened interpeduncular fossa, and bilaterally thickened, elongated,

horizontally oriented superior cerebellar peduncles. Together, these abnormalities formed the characteristic molar tooth sign. The combined supratentorial and infratentorial findings were considered compatible with a Joubert spectrum disorder associated with complete ACC (Figure 1).

DISCUSSION

The molar tooth sign is not merely an informal resemblance of the pons to a molar tooth. It is a composite anatomic sign generated by malformation of the pontomesencephalic junction: a deep interpeduncular fossa forms the central cleft, while enlarged and horizontally oriented superior cerebellar peduncles form the roots of the tooth [1,2]. Vermian hypoplasia or dysplasia completes the characteristic hindbrain phenotype. Precise description of these components is important because isolated vermian hypoplasia is insufficient to establish a Joubert spectrum diagnosis.

The classic neurologic phenotype includes early hypotonia followed by ataxia, variable developmental or cognitive impairment, abnormal ocular motor function, and episodic neonatal tachypnea or apnea [2-4]. Nevertheless, phenotypic severity is variable. Normal early motor and language milestones do not exclude a Joubert spectrum disorder, particularly when the molar tooth sign is unequivocal. In the present child, mild school difficulties represented the only reported neurodevelopmental concern. Their relationship to the hindbrain malformation, callosal agenesis, or both cannot be determined from a single observation. Formal neuropsychological assessment would be useful because callosal agenesis may be associated with subtle deficits in processing speed, complex reasoning, and novel problem solving despite otherwise preserved development [5].

Complete ACC produces a reproducible imaging pattern. In the absence of callosal fibers, the lateral ventricles remain parallel rather than converging anteriorly, creating the racing-car sign on axial images. Coronal eversion of the frontal horns produces the bull's-horn, longhorn, or Viking-helmet configuration. Posterior ventricular predominance accounts for colpocephaly, while superior extension of the third ventricle and widening of the interhemispheric fissure are additional supportive findings [5,6]. In this case, the convergence of these signs allowed confident radiologic recognition of complete ACC.

The association between Joubert syndrome and ACC has been documented in clinical imaging reports [7]. A molecularly characterized example involving biallelic MKS1 variants further supports a shared ciliopathy-related developmental mechanism in at least a subset of affected

individuals [8]. However, the presence of this association on imaging does not identify a causative gene. Genetic counseling and molecular testing remain appropriate when available, particularly because Joubert spectrum disorders are genetically heterogeneous and may involve the retina, kidneys, liver, and other organ systems [3,4,8,9]. Although the renal evaluation in this child was normal, longitudinal renal, hepatic, ophthalmologic, developmental, and neurologic surveillance should be considered [9].

The principal limitation of this report is the absence of a documented head circumference, detailed standardized neurologic and ophthalmologic assessment, and molecular confirmation. Accordingly, the most defensible conclusion is an imaging phenotype compatible with a Joubert spectrum disorder rather than assignment of a genetically defined subtype.

CONCLUSION

The simultaneous recognition of the molar tooth sign and the characteristic ventricular configuration of complete ACC permits a unified radiologic diagnosis. In a child with limited clinical manifestations, systematic evaluation of the pontomesencephalic junction, cerebellar vermis, corpus callosum, and ventricular morphology is essential. The association should prompt multidisciplinary clinical assessment, genetic counseling, and surveillance for possible multisystem involvement.

FIGURES

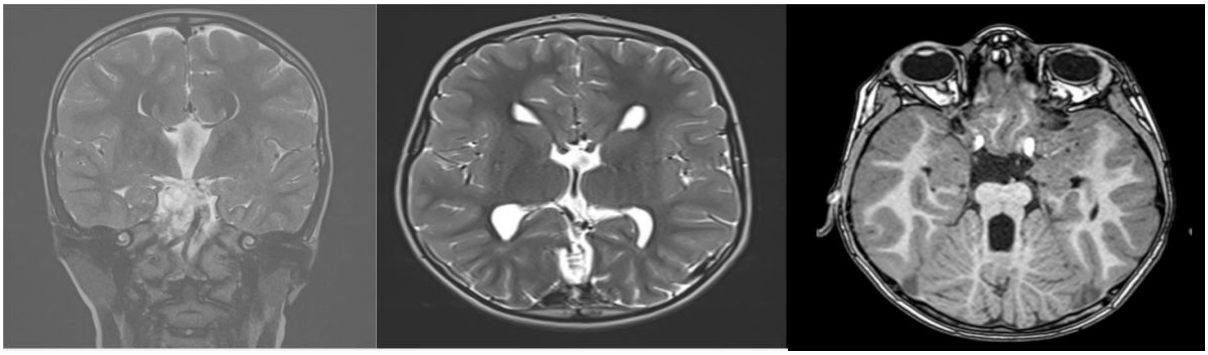

Figure 1. Characteristic brain MRI findings. From left to right: coronal T2-weighted image showing lateral eversion of the frontal horns, producing the bull's-horn appearance; axial T2-weighted image showing parallel and widely separated lateral ventricles, producing the racing-car sign; and axial image at the pontomesencephalic junction showing a deepened interpeduncular fossa with thickened, elongated, horizontally oriented superior cerebellar peduncles, producing the molar tooth sign.

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DECLARATIONS

Consent. Written informed consent for publication of this case and the anonymized images was obtained from the child's legal guardians.

Conflicts of interest. The authors declare no conflicts of interest.

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