

# Acute cerebellitis associated with rotavirus infection

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**Background:** Rotavirus infection is occasionally associated with central nervous system involvement, including cerebellitis. However, the precise clinical sequelae of central nervous system disorders and the usefulness of neuroradiological examination for clinical therapies, such as steroid pulse therapy, have not been clarified.

**Methods:** We present a case of rotavirus cerebellitis examined by magnetic resonance imaging (MRI), magnetic resonance spectroscopy, and single photon emission computed tomography.

**Results:** MRI demonstrated abnormal intensities in the right cerebellum on fluid attenuated inversion recovery images and, much more obviously, on diffusion-weighted images, but not on T1- or T2-weighted images. Single photon emission computed tomography showed only mild hypoperfusion in the right cerebellum on the 15th day, while 4 weeks later the image showed remarkably low perfusion in the right cerebellum.

**Conclusion:** The findings of the reported case suggest the importance of performing radiological examinations at early phases of the disease, especially by new modalities such as diffusion weighted imaging, to make timely and appropriate therapeutic decisions.

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**Key words:** cerebellar ataxia;  
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single photon emission  
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## Introduction

Rotavirus infection can occasionally be associated with central nervous system (CNS) involvement including cerebellitis. However, the precise clinical sequelae of CNS disorders and the usefulness of neuroradiological examination for informing clinical guidelines and therapies such as steroid pulse therapy have not been clarified.<sup>[1-3]</sup> These limitations seem to be due to lack of radiological findings such as magnetic resonance imaging (MRI) abnormalities, which have only been reported in several cases.<sup>[1-3]</sup>

We present a case of rotavirus cerebellitis examined by MRI, magnetic resonance spectroscopy (MRS) and single photon emission computed tomography (SPECT). The findings suggest the importance of radiological examinations at early phases of the disease, especially using new modalities such as diffusion-weighted imaging (DWI), MRS or SPECT, even after the clinical symptoms have disappeared to uncover the precise CNS manifestation associated with rotavirus infection.

## Case report

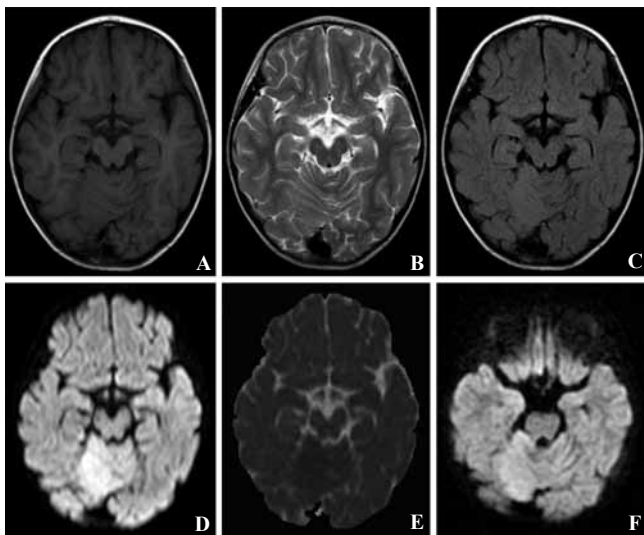
A 3-year-old girl was admitted to our hospital with a mild fever, accompanied with truncal ataxia and dysmetria predominantly in the right hand, suspected as having acute cerebellar ataxia (ACA). Seven days before admission, she showed a fever of approximately 39°C, vomiting, and diarrhea. These symptoms persisted for 2 days before her temperature decreased to approximately 37°C, while neurological abnormalities such as poor response to call and severe truncal ataxia became evident. The next day, she spoke with a slur and showed poor coordination of vocalizations. On admission, she had clear consciousness and response but slurred speech. Both pupils were equal in size and showed a prompt light reflex. Physical examination revealed her hands were clumsy, which resulted in poor feeding and poor picture drawing.

Laboratory data, including ammonia, glucose, serum creatine kinase and amylase levels were normal except for a mildly elevated C-reactive protein of 1.09 mg/dL. Cerebrospinal fluid (CSF) analysis showed 9 leukocytes/mm<sup>3</sup> (segmented, 1; mononuclear, 8), a glucose level of 64 mg/dL, and a protein level of

15 mg/dL. Rotavirus antigen was detected in a stool specimen using an immunochromatographic method. MRI demonstrated abnormal intensities in the right cerebellum on fluid attenuated inversion recovery (FLAIR) images and, much more obviously, on DWI, but not on T1- or T2-weighted images (Fig. 1A-E). Immediately after MRI, glycerol (20 g) and prednisolone (5 mg/kg) were administered after a diagnosis of acute cerebellar inflammation (cerebellitis), and the prednisolone therapy (5 mg/kg, twice a day) was continued for 5 days followed by dose tapering. An electroencephalogram taken the next day was normal.

Her symptoms of truncal ataxia and slurred speech quickly improved, but difficulty walking, predominantly on the right foot, and poor fine motor coordination of the right hand, as observed during picture drawing or toothbrushing, persisted for 1 week. One week after admission (14 days after the first symptoms), MRI showed remarkable improvement with mild abnormal intensities observed only on DWIs (Fig. 1F). Simultaneous MRS showed a metabolic abnormality of a low NAA/Cr ratio in the right cerebellum (NAA/Cr: right 0.69; left 0.95), indicating neuronal damage in the right cerebellum (Fig. 2A and 2B). Three weeks after admission the patient showed complete improvement clinically and the radiological findings on MRI, including DWI, normalized. SPECT showed only mild hypoperfusion in the right cerebellum on the 15th day, while 4 weeks later the image showed remarkably low perfusion in the right cerebellum (Fig. 2C and 2D).

Polymerase chain reaction analysis did not reveal

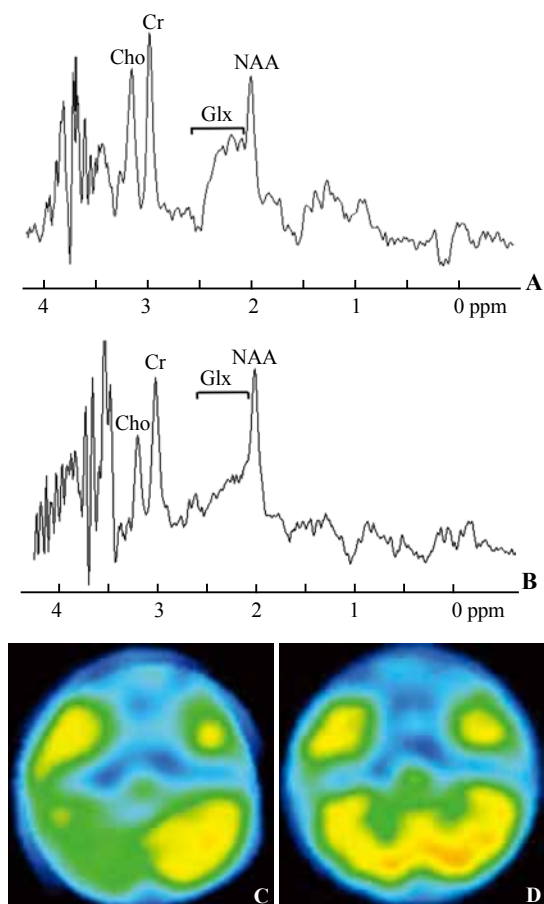


**Fig. 1.** MRI findings. **A:** T1-; **B:** T2-weighted; **C:** fluid attenuated inversion recovery; **D:** diffusion-weighted; **E:** apparent diffusion coefficient map images on the 8th day of illness; **F:** diffusion-weighted image on the 14th day of illness.

**Table. Cerebellitis in rotavirus infection**

Ref.	Sex	Age (y)	Seizure	Unconsciousness	Speech	Gait	Others	CSF (cells/mm <sup>3</sup> )	Rotavirus	EEG	CT	MRI	MRS	SPECT	Therapy	Clinical outcome
Nigrovic et al 2002 <sup>[4]</sup>	F	3	(+)	(+)	(+) loss	(+) wide	esotropia hypotonia screaming	2 (day 3) 17 (day 10)	stool (+) CSF (+)	ND	normal (day 3)	normal (day 3) T2 high, enlarged ventricle (day 10)	ND	ND	steroid (day 10) (20 mg/kg, 5 d) ventricular drainage	wide-based gait moderate aphasia
Shiuhara et al 2007 <sup>[5]</sup>	F	2	(+)	(+)	(+) slow	(+) wide	tremor hypotonia	47 (day 3)	stool (+) CSF (-)	occipital high delta wave (day 5) occipital high theta wave (day 8)	diminished effacement of sulci (day 5)	normal (day 29) wide sulci, enlarged ventricle (day 180)	ND	ND	methylprednisolone (day 4) (30 mg/kg/d, 3 d, twice)	slow speech dysarthria right hand tremor
Shiuhara et al 2007 <sup>[5]</sup>	M	4	(-)	(+)	(+) slow, dysarthria	(+) wide	tremor hypotonia	3 (day 7) 13 (day 29)	stool (+) CSF (-)	normal (day 23)	ND	normal (day 7) T2 high (day 29) wide sulci (day 93)	ND	ND	methylprednisolone (day 36) (30 mg/kg/d, 3 d, once)	slow speech, dysarthria hand tremor
Dickey et al 2009 <sup>[1]</sup>	F	3	(-)	(+)	(+) somnolent	(+) wide	screaming hypotonia swallowing difficulty	22 (day 3) normal (day 9)	stool (+) CSF (+)	general slowing	normal	T2 high (day 9)	"consistent with encephalitis" (day 9)	ND	acyclovir, vancomycin, ceftriaxone	motor and speech incoordination
Kato et al (present case)	F	3	(-)	(+)	(+) somnolent, slurred	(+) wide	tremor	9 (day 7)	stool (+) CSF (-)	normal (day 8) normal (day 15)	normal (day 7)	FLAIR mild high, DWI high (day 7) DWI mild high (day 14) normal (day 35)	mild decrease (day 8) decreased (day 14) severe decrease (day 28)	prednisolone (day 7) (5 mg/kg, 5 d)	normal	

CSF: cerebrospinal fluid; EEG: electroencephalography; MRI: magnetic resonance imaging; MRS: magnetic resonance spectroscopy; SPECT: single photon emission computed tomography; F: female, M: male; ND: not described; NAA: N-acetyl aspartate; day: days after onset of initial symptoms.



**Fig. 2.** MRS and SPECT findings. MRS spectra obtained from the cerebellar hemispheres. **A:** right hemisphere; **B:** left hemisphere on the 14th day of illness; **C & D:** SPECT of cerebellum on the 8th and 28th days of illness, respectively.

the presence of rotavirus genome in her CSF, but did in her stool and subsequent sequencing identified the strain as group A, serum type 1.

## Discussion

To date, four cerebellitis cases during rotavirus infection have been reported (Table).<sup>[1,4,5]</sup> In one case, only antibiotics were administered, and in the other three cases, the intervals from admission to the start of steroids were 2, 7 and 26 days respectively (Table). Usually when a clinical diagnosis of ACA is made, there would be an observational period without any specific therapy.<sup>[6,7]</sup> Our case was initially admitted to our hospital with a diagnosis of ACA, but the DWI revealed the lesion clearly (Fig. 1), which led to the decision to use steroid immediately. The initial MRIs on T1 or T2 weighted images were described as normal in three of the four reported cases (Table), but abnormal findings might have been detected on FLAIR

or DWI, as observed in our patient.<sup>[8,9]</sup> There may be an increased risk to have neurological sequelae after cerebellitis<sup>[1,4,5]</sup> if there is a longer lag before therapeutic intervention. Currently, ACA may be defined by acute cerebellar symptoms with the absence of obvious radiological findings, but future radiological techniques should narrow the clinical definition, identifying new categories.<sup>[9,10]</sup>

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**Contributors:** Kato Z wrote the first draft of this paper. Kato Z, Sasai H, Funato M and Kondo N treated the patient and obtained the clinical and laboratory data. Kato Z and Asano T analyzed the radiological data. All the authors contributed to the intellectual content and approved the final version.

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