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Wada Demonstrates Ipsilateral Language Function in Dyke-Davidoff-Masson Syndrome

Rutul Shah[1,2] Siby Gopinath[1] Abhishek Gohel[1,2] Sreelakshmi Narayanan[1] Ashok Pillai[3] Ramiah Rajesh Kannan[4] Talal Almashaikhi[5]

[1] Department of Neurology, Amrita Advanced Centre for Epilepsy, Amrita Institute of Medical Sciences and Research Centre, Kochi, Kerala, India
[2] Department of Neurology, K. D. Hospital, Ahmedabad, Gujarat, India
[3] Department of Neurosurgery, Amrita Advanced Centre for Epilepsy, Amrita Institute of Medical Sciences and Research Center, Kochi, Kerala, India
[4] Department of Neuroradiology, Amrita Advanced Centre for Epilepsy, Amrita Institute of Medical Sciences and Research Center, Kochi, Kerala, India
[5] Department of Clinical Physiology, Sultan Qaboos University Hospital, Seeb, Oman

Address for correspondence Siby Gopinath, DNB (Neurology), Department of Neurology, Amrita Advanced Centre for Epilepsy, Amrita Institute of Medical Science, Kochi, Kerala 682041, India (e-mail: sibygopi@gmail.com).

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Abstract

Dyke-Davidoff-Masson syndrome (DDMS) is usually described secondary to prenatal or perinatal insult and is characterized by seizures, cerebral hemiatrophy, hemiparesis/facial asymmetry, and learning disability. We report an adolescent-onset case who presented with drug-refractory seizures and was considered for hemispherotomy on the dominant side. This is the first case report of DDMS where Wada helped in lateralizing the language to the ipsilateral dominant hemisphere despite the atrophy of the left inferior frontal gyrus. Thus, Wada is recommended in all patients without language regression who are considered for dominant hemispherotomy.

Keywords
- Dyke-Davidoff-Masson syndrome
- epilepsy
- Wada test

Introduction

Dyke-Davidoff-Masson syndrome (DDMS) is characterized by seizures, cerebral hemiatrophy, hemiparesis/facial asymmetry, and learning disability. The initial cases described by Dyke, Davidoff, and Mason were due to prenatal insult, but it is also known to result from perinatal or postnatal insult.[1,2] Common perinatal insults include hypoglycemia, hypoxia, trauma, or infection while tumor status epilepticus and prolonged febrile seizures are additionally described as postnatal causes. Even though DDMS is a childhood-onset disease, cases of adult-onset DDMS have been reported.[3] DDMS is a rare disorder with a close differential diagnosis of Rasmussen's encephalitis (RE).

Hemispherotomy is the primary surgical treatment considered for drug-refractory epilepsy (DRE) in DDMS. Language lateralization is important in any patient planned for hemispherotomy to assess the risk of postoperative aphasia. Formal language lateralization in the dominant affected hemisphere has not yet been reported in DDMS.[4] We report the first case of a Wada test done for DDMS acquired in adolescence with drug-refractory seizures demonstrating ipsilateral language dominance.

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Case Description

A 43-year-old gentleman was referred to our center for DRE. He was born from nonconsanguineous parentage at full term via vaginal delivery with normal birth weight. He achieved normal developmental milestones at an age comparable to his peers. Academic performance was satisfactory until the age of 15 years, when he developed insidious onset, gradually progressive weakness of the right upper and lower limbs which progressed over a 5-year period to finally develop a weak handgrip with minimal proximal weakness of the upper limb. He used to walk independently, despite having a hemiparetic gait. He developed seizures around the same age, characterized by an aura of palpitations followed by right upper and lower limb tonic posturing of $<$ 1-minute duration without any noticeable postictal aphasia. These events initially occurred at a frequency of 2 to 5 episodes daily; however, the frequency was reduced to once or twice weekly while on chronic antiseizure medications. A drop in academic performance and learning abilities was noted after the disease onset. Though right-handed since birth, he began doing all his activities of daily living, and writing, with his left hand since the onset of hemiparesis. No regression in language or epilepsia partialis continua was noted during the entire course of his illness. No relevant past medical history or family history of neurological illness was elicited. The patient had right homonymous hemianopia, upper and lower limb spasticity, hemiparesis, and proximal more than distal weakness with weak hand grip. Western aphasia battery did not reveal any language abnormalities and Frenchay dysarthria assessment was normal.

Diagnostic Assessment

During prolonged video electroencephalogram (EEG), the interictal record showed continuous theta range slowing in the left hemisphere. No interictal epileptiform activity was noted. We recorded five electroclinical events characterized by hypermotor seizures semiologically lateralizing to the left hemisphere though the corresponding ictal EEG was obscured by artifacts.

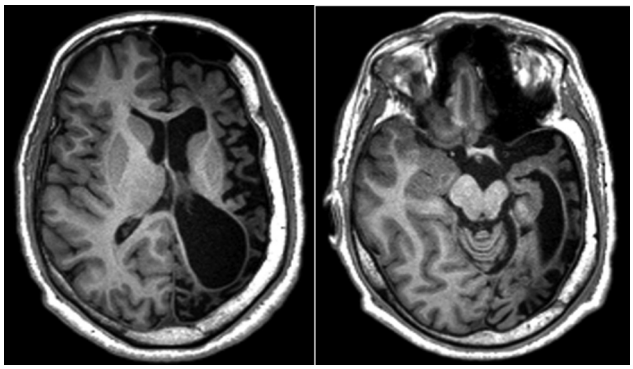

Fig. 1 MRI brain T1 axial section shows significant left hemispheric atrophy along with ex vacuo dilatation of ventricles and atrophy of crus cerebri. The basal ganglia and thalamus are relatively spared. Thickened calvarium on the left side and hyperpneumatization of frontal sinuses is also noted.

►**Fig. 1** shows the magnetic resonance imaging (MRI) findings. A neuromorphometric analysis was performed on T1 MPRAGE sequences and a significant volume loss was noted in the left hemispheric structures. The inferior frontal gyrus (IFG) opercular volume calculated was 1.3 mL on the left side and 3.1 mL on the right, suggesting a significant atrophy of the left IFG. The possibility of DDMS was considered in this setting, although RE was a differential diagnosis. However, the clinical and neuroimaging findings were in favor of DDMS over RE (no language regression, lack of caudate atrophy, and hyperpneumatization of frontal sinus). The surgical option of hemispherotomy was considered, given seizures lateralizing to the left hemisphere, significant left cerebral atrophy along with right hemiparesis. However, in view of the patient being right-handed until the onset of the illness, the possibility of left hemispheric dominance could not be ignored. Despite significant left hemispheric atrophy, there was no clear evidence to indicate a shift in the language center to the right. Moreover, there was no evidence of aphasia during the course of the illness.

Thus, a Wada test to lateralize the language function was performed. The patient correctly identified five objects before the Wada test and read the test sentence accurately. The check angiogram performed showed no evidence of persistence of fetal vessels or interhemispheric connectivity. A bolus of 2 mg etomidate was administered in the left internal carotid artery (ICA) followed by infusion at 12 mg/hour. After 13 seconds, the patient lost the power in the right upper limb, and language assessment was done by asking the patient to identify 5 pictures and 10 objects. The patient was completely aphasic during the left ICA injection. Five minutes after stopping the intra-arterial infusion, he regained his baseline motor power on the right side.

The already attenuated left hemispheric electrical activity was further suppressed with the right hemispheric activity being unaltered. A right hemispheric assessment was aborted after the bolus dose as there was depression of sensorium possibly due to the suppression of the only functioning right hemispheric cortex. The patient tolerated the procedure well and no adverse events were recorded. The Wada test suggested the presence of significant language function in the left hemisphere with or without colateralization to the right hemisphere.

Therefore, given the risk of significant postoperative aphasia in a patient with otherwise normal speech, the option of hemispherotomy was abandoned. The possibility of invasive EEG followed by focal resections was also not favored given the imaging findings of holohemispheric atrophy with no clear lobar or sublobar electroclinical localization for stereoelectroencephalography. The patient finally opted for neuromodulation at a later date.

Discussion

DDMS is a rare disorder that should be considered in DRE with hemiparesis and hemispheric atrophy. Literature describing aphasia in DDMS is scarce. The presence of crossed nonaphasia has been reported in DDMS affecting the dominant hemisphere but a language lateralization test like

Table 1 RE vs. DDMS: clinical and imaging features

Rasmussen's encephalitis	DDMS
Caudate atrophied	Relatively preserved
EPC	Unlikely
Frontal sinus hyperpneumatization and ipsilateral calvarial thickening – Uncommon	Frontal sinus hyperpneumatization and ipsilateral calvarial thickening is common
Language regression in dominant hemisphere – Common	Language regression and lateralization unclear

Abbreviations: DDMS, Dyke-Davidoff-Masson syndrome; EPC, epilepsia partialis continua; RE, Rasmussen's encephalitis.

functional MRI (fMRI) or Wada was not performed.[4] Shift of language to the contralateral hemisphere has also been demonstrated by fMRI in a case with probable DDMS.[5] Moreover, available literature on DDMS fails to conclude if contralateral language shift is possible when the dominant hemisphere is affected.

This is the first case report of DDMS of the dominant hemisphere with Wada documentation of ipsilateral functioning language cortex. This finding is contrary to the traditional belief of transfer of language function when hemispheric atrophy sets in and has important implications in planning epilepsy surgery in DDMS.[6] A retrospective study on patients who underwent left hemispherotomy for seizures secondary to early acquired brain lesions concluded that the language shift may happen in the patients and worsening following hemispherotomy is unlikely especially if IFG is atrophied.[7] In our case, the patient had childhood injury of dominant hemisphere and atrophy of IFG, Wada testing suggested the language lateralization ipsilateral on the left. These findings are not surprising as it has been reported that interhemispheric language shift after an insult at an early age may not be seen and a false negative Wada could still result in aphasia following surgery.[8] The language dominance of the hemisphere depends on the extent of preservation of the language areas of the cortex.[6] In our case, the reason for selective preservation of language in the diseased left hemisphere in the presence of IFG atrophy is unknown.

In some instances of childhood-onset of seizures with hemiparesis and dominant hemispheric atrophy presenting in adulthood, it is difficult to identify the etiology of the illness. The two essential differentials of RE and DDMS were applied to this case. A few clinical and radiological points may help in their differentiation (►**Table 1**). Also, congenital cases of DDMS can be differentiated from the acquired ones by the presence of a thin corpus callosum. The presence of schizencephalic cleft and absence of septum pellucidum suggest a congenital DDMS and cerebellar atrophy suggests acquired DDMS.[2] The treatment of choice for RE is immunotherapy trial and hemispherotomy. Good seizure-free outcome following hemispherotomy for DDMS has been well documented, whereas immunotherapy has not been described.[9] The primary surgical option for DRE in both situations is hemispherotomy, however, language lateralization remains crucial in this decision for which Wada still remains the gold standard.

This case's findings open a new line of enquiry about the reason for selective preservation of language suggesting a different cerebral insult for DDMS compared to RE. Perhaps a pathological understanding of this difference might lead to insights into language preservation in RE.

Conclusion

DDMS is a rare disease which is a close differential of RE especially when the presentation is late. If a dominant hemispherotomy is considered in the absence of language regression, a lateralization test like Wada should be performed regardless of the presence or absence of language cortex atrophy.

Note

The current work has not previously been presented in a meeting or a conference.

Conflict of Interest

None declared.

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