



Cerebral Vasculitis in a Pediatric Staphylococcal Meningitis: A Case Report

Authors

Md Nawad Azam^{1*}, Bendangienla Jamir², Senthil Kumar SP³

¹Fellow in Paediatric Intensive Care

²fellow in Pediatric Intensive Care

³Consultant Paediatric, Neonatal & Cardiac Intensivist

Department of Paediatrics & Neonatology, Columbia Asia hospital, Whitefield, Bangalore, Karnataka, India

*Corresponding Author

Dr Md. Nawad Azam

201, Adityadesai Orchid Apartment, Nagraj Layout, Vijayanagar, Dr. Amedkarnagar Road,
Whitefield, Bangalore, Karnataka-560066, India

Abstract

Background: Cerebral vasculitis is a dreadful complication of bacterial meningitis leading to significant morbidity and mortality. Pathology behind this complication can be attributed to intra-arterial thrombosis, arteritis and vasospasm. We report our experience of cerebrovascular complication in staphylococcal meningitis in an 11 month old female child.

Case Presentation: 11 month old previously healthy female child presented with fever and multiple episodes of seizure. After initial stabilization child was found to have bacterial meningitis which later found to be caused by *Staphylococcus aureus*. MRI brain was suggestive of acute infarcts and MR angiography showed ICA occlusion affecting both sides. She was treated with sensitive antibiotics, IVIG and aspirin. Child showed marked clinical improvement and discharged in good health and presently on regular follow up.

Conclusion: Although few cases of cerebral vasculitis in bacterial meningitis have been reported before, community acquired staphylococcal meningitis complicating with central nervous system vasculitis in pediatric age group is a rarity. Similarly there is no evidence base recommendation in treating cerebral vasculitis associated with severe bacterial infection with sporadic reports of effectiveness of high dose IV methylprednisolone, IVIG, immunosuppressive therapy etc.

Keyword: Bacterial meningitis, *Staphylococcus aureus*, CNS vasculitis, Magnetic resonance Angiography (MRA), Immunoglobulin (IVIG), Aspirin, Methyl prednisolone.

Introduction

CNS vasculitis in children can be primary or secondary to underlying infectious, immunological or collagen vascular diseases^[1]. Cerebro-vascular complication in bacterial meningitis is a rare dreadful condition seen in 9-

25% of cases^[2]. They may present with intractable seizures, cognitive deficit, cranial nerve involvement, weakness or other focal neurological deficit. Community acquired staphylococcal meningitis is a rare entity in itself and can cause neurological complications leading to high

mortality and neurological sequelae. MRI brain with angiography can identify cerebral vasculitis with reasonable accuracy, hence included as primary modality in the evaluation [3]. Various treatment modalities have been used like IVIG, steroids, immunosuppressive agents to treat cerebral vasculitis and to prevent its long term complications [4].

We discuss here our experience and difficulties in treating a rare staphylococcal meningitis with CNS vasculitis.

Case Report

A previously healthy 11 month old female child presented with fever for 2 days and multiple episodes of seizure. Seizure was aborted with 2 anticonvulsant but child continued to have altered sensorium and irritability. After initial stabilization she was shifted to PICU. She had no past h/o seizure, abnormal developmental milestone, repeated cough, cold or any congenital heart ailments. Initial blood investigation showed neutrophilic leukocytosis, high CRP (11.86mg/dl), and normal metabolic parameters. Blood culture was sent and she was started on Intra venous (IV) ceftriaxone. CSF study analysis showed CSF pleocytosis (cells-820 cells/mm³, 16% neutrophil, 94% Lymphocytes), CSF protein-102 mg/dl, and Sugar-40 mg/dl. Both CSF and blood culture showed growth of staphylococcus aureus. Following which vancomycin was added to antibiotic regimen.

On Day 4 of treatment child had multiple seizures requiring further anticonvulsants with altered behavior and persistence of fever. MRI brain done showed meningeal enhancement with multiple acute infarcts involving bilateral deep and cortical watershed territories, bilateral temporal, occipital, right cerebellum, left vermis and left pons (Figure-1). MR angiography showed critical narrowing of right and left petrous part of internal carotid artery (ICA) (figure-2). Antibiotics were upgraded to IV Meropenem and vancomycin. IVIG was infused at 1gm/kg/day for 2 days as parents did not give consent for steroids in view of

apparent exacerbation of severe bacterial infection. USG abdomen and pelvis showed no abnormalities, Echocardiography was done to rule out infective endocarditis, coagulation study was within normal limit, Immunoglobulin levels were done before IVIG infusion and found to be within normal range. Immunological studies, ANCA, ANA, and Complements were negative.

Gradually child showed marked clinical improvement with decreasing inflammatory markers, repeat blood culture after 2 weeks of antibiotic was negative and repeat CSF study showed decrease in cell count (40cells/mm³, all lymphocyte). CT angiography showed near complete occlusion of left distal ICA and partial occlusion of right ICA. Parents were offered treatment options of aspirin, low dose dexamethasone and low molecular weight Heparin (LMWH) for treatment of vasculitis but they only opted for aspirin. Child was discharged in good health with no focal neurological deficits after completion of 4 weeks IV antibiotics with oral aspirin and anticonvulsant.

Repeat CT angiography done on follow up after 6 weeks showed complete revascularization of anterior circulation of brain with collateral circulation arising from basilar artery in the form of prominent bilateral posterior communicating arteries (Figure-3)

Currently the child is on regular follow up with us, neurologically normal on oral aspirin.

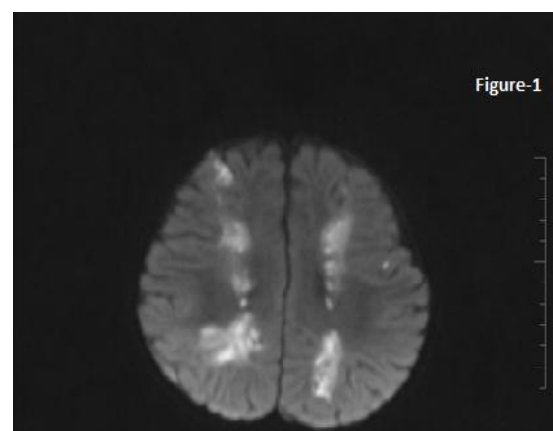


Figure-1 DW-MRI suggestive multiple infarct affecting bilateral watershed territories

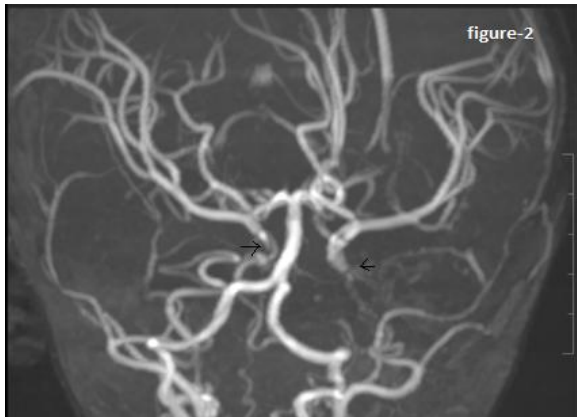


Figure-2 MR- angiography showing multiple areas of critical narrowing of bilateral ICA shown by arrow.

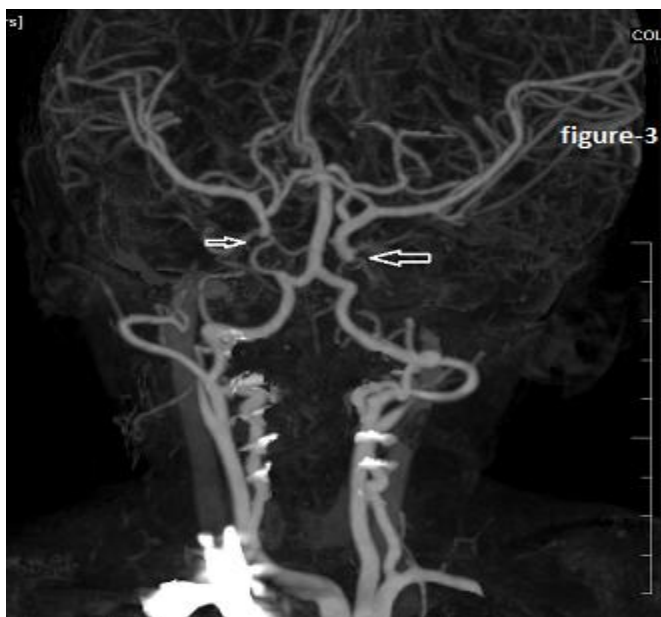


Figure-3 CT angiography showing near complete occlusion of bilateral ICA and complete revascularization of anterior circulation from collaterals arising from basilar artery.

Discussion

Community acquired staphylococcal meningitis is a relatively rare disease as most of the staphylococcal meningitis reported were post traumatic, post neurosurgical, catheter induced or extension of skin lesions^[5]. Bacterial meningitis is associated with Sensorineural hearing loss, seizures, motor weakness, hydrocephalus, and cerebro vascular complication in early stages and may lead to mental retardation, cognitive, academic, and behavioral problems later^[6]. Vascular complication in meningitis can be

attributed by varied pathophysiology including arteritis, vascular spasm, thrombo-embolic, intra-arterial thrombosis^[7,8]. This may lead to cerebral infarction and stroke in bacterial meningitis by 4-14 days of time. In our case child had intractable seizure and altered sensorium as early as day 5 of disease.

MRI can identify bacterial meningitis and cerebral vasculitis with sensitivity of 90% based on findings including meningeal enhancement, white matter lesion, ischemic lesions, and arterial lesions^[9]. Diffusion weighted MRI (DW-MRI) is more sensitive than T2W, Fluid Attenuation Inversion Recovery (FLAIR) sequence in identifying cerebral vascular lesions^[10]. MR angiography is considered initial mode of investigation in diagnosis of CNS vasculitis but convention CT angiography is still more sensitive and considered gold standard in identifying CNS vasculitis^[3]. In our case MRI clearly suggest meningeal enhancement with infarction affecting multiple areas involving cerebral hemisphere and cerebellum with MRA suggesting bilateral ICA involvement.

To date there has been no recommendation about the optimal treatment strategy of CNS vasculitis secondary bacterial infection in pediatric age group. Multiple treatment strategies including IVIG^[11], high dose methyl prednisolone with IV antibiotics^[12], immunosuppressive agents, anticoagulation, aspirin has been tried with variable results.

American Heart Association/American Stroke Association recommends aspirin^[13] while the Royal College of Physicians recommends anticoagulation (LMWH)^[14] in treatment acute CNS vasculitis. It is worth mentioning that these recommendation has developed based on expert consensus rather than trial data.

Conclusion

Community acquired staphylococcus aureus meningitis is relatively rare entity but can present with dreadful complications like CNS vasculitis with long term neurological sequelae. MRI brain

and MR angiography can identify CNS vasculitis with reasonable accuracy. However there is paucity of clinical trial based recommendation of treatment strategies in pediatric age group.

Acknowledgment

We are grateful to dept. of radio-diagnosis, CAHW for their valuable input. Special thanks to Dr. Kabeer (dept. of radio-diagnosis) for his assistance.

Declaration

The Authors declare that there is no conflict of interest

References

1. S. Benseler and R. Schneider, "Central nervous system vasculitis in children," *Current Opinion in Rheumatology*, vol. 16, no.1, pp. 43–50, 2004
2. Fugate JE, Lyons JL, Thakur KT, Smith BR, Hedley-Whyte ET, Mateen FJ. Infectious causes of stroke. *Lancet Infect Dis* 2014;14:869-80.
3. D. Eleftheriou, et.al "Investigation of childhood central nervous system vasculitis: magnetic resonance angiography versus catheter cerebral angiography," *Developmental Medicine and Child Neurology*, vol. 52, no. 9, pp. 863–867, 2010.
4. Ludovico Iannetti, et al. "Recent Understanding on Diagnosis and Management of Central Nervous System Vasculitis in Children," *Clinical and Developmental Immunology*, vol. 2012, Article ID 698327, 9 pages
5. Lerche A, et al. Staphylococcus aureus meningitis: a review of 28 consecutive community acquired cases. *Scand J Infect Dis* 1995;27:569-573.
6. Oostenbrink R, Maas M, Moons KG, Moll HA. Sequelae after bacterial meningitis in childhood. *Scand J Infect Dis*. 2002;34:379--82.
7. Pfister HW, Feiden W, Einhaupl KM: Spectrum of complications during bacterial meningitis in adults. Results of a prospective clinical study. *Arch Neurol* 1993, 50:575-581.
8. Lyons EL, Leeds NE: The angiographic demonstration of arterial vascular disease in purulent meningitis. Report of a case. *Radiology* 1967, 88:935-938.
9. Regaieg K, et al. Vasculite cérébrale: une complication rare de la méningite à *Streptococcus pneumoniae*. *Med Mal Infect*. 2016;46:3.
10. Tsuchiya K, et al. Diffusion-weighted MR imaging of encephalitis. *AJR Am J Roentgenol* 1999; 173(4):1097-9
11. Lukán N. Intravenous immunoglobulin therapy in primary vasculitides. In Amezcua-Guerra LM, editor. *Advances in the diagnosis and treatment of vasculitis*. 4th ed. Rijeka: InTech; 2011. p. 149-66.
12. Brouwer MC, McIntyre P, Prasad K, van de Beek D. Corticosteroids for acute bacterial meningitis. *Cochrane Database Syst Rev*. 2013;6:CD004405
13. Roach ES et al; American Heart Association Stroke Council; Council on Cardiovascular Disease in the Young. Management of stroke in infants and children: a scientific statement from a Special Writing Group of the American Heart Association Stroke Council and the Council on Cardiovascular Disease in the Young. *Stroke*. 2008;39(9):2644–2691
14. Paediatric Stroke Working Group. *Stroke in Childhood: Clinical Guidelines for Diagnosis, Management and Rehabilitation*. London, UK: Royal College of Physicians; 2004. Available at: www.rcpch.ac.uk/system/files/protected/page/RCP%20-%20Stroke%20in%20childhood%2020015_0.pdf