



“ CT AND MRI IN ASSESSMENT OF MENINGITIS AND MENINGOENCEPHALITIS PATIENTS”

Dr. Dharmendra Malviya^{1*}, Dr. Rajkumari Rawat²

¹Senior Resident, Department of Radiodiagnosis MY Hospital, MGM Medical college, Indore, 452001, Mail id dmalviya820@gmail.com

²Assistant professor, Department of Radiodiagnosis Sri Aurobindo institute of medical science, Indore 453555, Mail id - rajkumarirawat2020@gmail.com

***Corresponding author:** Dr. Dharmendra Malviya

*Email id dmalviya820@gmail.com

Abstract-

Introduction: Meningitis is a clinical syndrome characterized by inflammation of meninges. The classic triad of meningitis consists of fever, headache and neck stiffness. Encephalitis presents as diffuse or focal neuropsychological dysfunction although it primarily involves the brain, it often involves the meninges as well (meningoencephalitis). This study is done to emphasize the importance of early diagnosis, so that prompt management is given at appropriate time.

Aim: This is a prospective observational, single center study done in Department of medicine and radiology in MGM medical college and MY hospital Indore in 93 patients of acute meningoencephalitis cases from 1st March to 2021 to 1st March August 2023. The main aim of this study is “ CT and MRI in assessment of meningitis and meningo-encephalitis patients”.

Materials And Methods: In the present study, we recruited 93 patients who presented with meningitis and meningoencephalitis who fulfilled the inclusion criteria. Proforma is used to collect data needed. Data are statistically analysed. The data will be recorded in the predesigned proforma and then It will be entered in the MS excel and eventually it will be analysed by using statistical software -SPSS version 23. Association of qualitative data will be tested by chi square test and fischer exact test, Student t test will be applied in quantitative data. A p value < 0.05 will be considered significant.

Results: Among the 93 patients with meningo-encephalitis in this study. the common initial presenting symptoms were fever (89%) and Vomiting (89%) > altered sensorium > headache and neck pain and stiffness> Focal neurological deficit> seizure. Fever was the most common initial presenting symptom. 86 patients (92.5%) had fever and headache (92.5%). Most of them had poor prognosis and presented with altered sensorium and high-grade fever. On investigation we found that 0 = Normal, 1 = Meningeal Enhancement, 2 = Hydrocephalus, 3 = Granuloma, 4= Vasculitic infarct, 5 = Other findings (Thrombosis, Sinusitis, Icsol, Gliosis) found.

Conclusion: In the present study we found that, most of the patients with meningoencephalitis were males and young adults. Tuberculous meningitis was the most common cause in patient with subacute meningitis. All patients with chronic presentation had tuberculous meningitis. We came across atypical presentation of cryptococcal meningitis in a non-HIV patient. 47 patients recovered well without neurological deficits.

Keywords- meningo-encephalitis, tuberculosis, vasculitis.

INTRODUCTION

Meningitis is a clinical syndrome characterized by inflammation of meninges. The classic triad of meningitis consists of fever, headache and neck stiffness¹. Bacterial meningitis occurs in about 3 people per 100,000 annually in western countries. Population-wide studies have shown that viral meningitis is more common at 10.9 per 100,000² population.

Bacterial (pyogenic) meningitis is a pyogenic inflammation of meninges and subarachnoid cerebrospinal fluid (CSF) and is characterized by neutrophilic pleocytosis in CSF³. Pneumococcal meningitis is caused by streptococcus pneumonia, a gram-positive coccus and is the most common bacterial cause of meningitis. Meningococcal meningitis is caused by gram-negative diplococcus - *Neisseria meningitidis*. Most patients recover completely if appropriate antibiotic therapy is instituted promptly³.

World-wide causes of viral meningitis include enterovirus, herpes, mumps, measles and HIV. Enterovirus is the most common cause of viral meningitis.

Aseptic meningitis is an illness characterized by serious inflammation of the meninges, usually with an accompanying CSF lymphocyte pleocytosis. Clinical manifestations vary with headache and fever predominating. The illness is usually mild and runs its course without treatment, however some cases can be severe and life threatening.

The clinical presentation is encephalopathy with diffuse or focal neurological symptoms including behavioral and personality changes, with decreased level of consciousness, neck pain/stiffness, photophobia, lethargy, generalized or focal seizures, acute confusion or amnesic states and flaccid paralysis⁸.

There are no studies done till now showing the clinical, etiological and outcome in patients with meningitis and meningoencephalitis. There are some studies done in children but not in adults.

Distinguishing the etiologies also helps in terms of both reducing antibiotic usage and hospital bed occupancy and reassuring contacts of cases and health care staff of a non-bacterial cause. As there are fewer developments in therapies for viral meningitis and there remain no effective therapies for most pathogens, this study is done to emphasize the importance of early diagnosis, so that prompt management is given at appropriate time.

AIMS & OBJECTIVE

This is a prospective observational, single center study done in Department of medicine and radiology in MGM medical college and MY hospital Indore in 93 patients of acute meningoencephalitis cases from 1st March to 2021 to 1st March August 2023. The main aim of this study is “ CT and MRI in assessment of meningitis and meningo-encephalitis patients”.

INCLUSION CRITERIA:

- Patients fulfilling the diagnostic criteria for encephalitis
- People willing to give consent for CSF lumbar puncture
- Age more than 14 years

EXCLUSION CRITERIA:

- People not willing to give consent for CSF lumbar puncture
- Age criteria less than 14 year of age
- Known case of Rheumatic heart disease (According to modified Jones criteria)
- Patients with organic central nervous system disease, endocrine disorders, uremia, severe electrolyte disturbances, and drug reactions

MATERIALS & METHODS

This is a prospective observational, single center study done in Department of medicine and radiology in MGM medical college and MY hospital Indore in 93 patients of acute meningoencephalitis cases from 1st March to 2021 to 1st March August 2023. The main aim of this study is “ CT and MRI in

assessment of meningitis and meningo-encephalitis patients”. This study will be approved by institutional ethical committee and written informed consent will be obtained from all participants before inclusion in the study. All patients fulfilling the following criteria will be enrolled

The data will be recorded in the predesigned proforma and then it will be entered in the MS excel and eventually it will be analysed by using statistical software -SPSS version 23. Association of qualitative data will be tested by chi square test and Fischer exact test; Student t test will be applied in quantitative data. A p value < 0.05 will be considered significant.

OBSERVATION AND RESULTS

-Out of the total 93 study participants, 47(50.5) were males and 46(49.5%) are Females. -Age wise distribution of the study participants in the above table shows most of the patients were of young adults <50 yr of age group. 8 patients were in the group of 51 -60, 9 patients were elderly adults >60 yr age group.

-Among the 93 patients with meningo-encephalitis in this study, the common initial presenting symptoms were fever (89%) and Vomiting (89%) > altered sensorium > headache and neck pain and stiffness> Focal neurological deficit> seizure. Fever was the most common initial presenting symptom. 86 patients (92.5%) had fever and headache (92.5%).

PREVALENCE OF POSITIVE CLINICAL PRESENTATION TABLE NO. 1

CLINICAL PROFILE - SIGN AND SYMPTOMS		
CLINICAL PRESENTATION	N	(%)
Fever	86	93%
Headache	45	48%
Neck pain	45	48%
Vomiting	86	93%
Focal neurological deficit	21	22%
Cranial Nerve Palsy	5	5%
Blurring of vision/photophobia	5	5%
Coordination and gait	16	17%
Seizures	16	17%
Dysphagia	6	6.5%
Altered mental status	58	62.4%
Loss of Consciousness	7	7.5%
Behavioural disturbance	71	76.3%
Abnormal reflexes	6	6.5%
Kernig sign	76	81.8%
Brudzinski sign	30	32.5%
Neck rigidity	86	92.5%
Papilledema	45	48.4%

-Headache was associated with vomiting in some of the patients. 45 patients had both fever and headache. 58 patients had altered sensorium in the course of illness, varying from drowsiness to deep coma. Only 45 patients had all the three triad – headache, fever and altered sensorium. -16 patients had seizures during the course of illness. 5 patients had generalized tonic clonic seizures. 11 patients had focal motor seizures.

-Among 93 patients, 37 patients were diagnosed as Tubercular meningitis. 31 patients were diagnosed as pyogenic meningitis; 25 patients were diagnosed as viral meningoencephalitis. My study also has male and younger predominance and Tubercular meningitis was the most common cause found which was followed by Bacterial meningitis and then Viral meningitis. -In case of viral meningitis, out of total 93 patient, 25 patient were diagnosed on the basis of csf analysis, clinical finding, radiological

evidence and biochemical parameter with s-crp as viral meningitis. most of the case out of 25 had s-crp value range <6mg/l (19 patients) followed by 3 patient had range between 6-12 mg/l followed by 2 patient had range between 12-24 mg/l and 1 patient exceptionally had s-crp more than 48 mg/l who had sepsis also.

TABLE NO. 2 TABLE SHOWING POSITIVE MRI AND CT FINDINGS IN DIFFERENT ETIOLOGICAL MENINGITIS

Radiological Findings (CT and MRI)	Number of Cases	Percent
(0) Normal	44	47.3
(1) Meningeal Enhancement	8	8.6
(1,2,4) Meningeal Enhancement, Hydrocephalus, Vasculitis infarct	2	2.2
(1,4) Meningeal Enhancement, Vasculitic infarct	1	1.1
(2) Hydrocephalus	8	8.6
(2,3) Hydrocephalus, Granuloma	1	1.1
(2,4) Hydrocephalus, Vasculitic infarct	3	3.2
(3) Granuloma	4	4.3
(3,4) Granuloma, Vasculitic infarct	1	1.1
4 Vasculitic infarct	12	12.9
(4,5) Vasculitic infarct, other findings	1	1.1
(5) Other findings	8	8.6
Total	93	100

0 = Normal, 1 = Meningeal Enhancement, 2 = Hydrocephalus, 3 = Granuloma, 4= Vasculitic infarct, 5 = Other findings (Thrombosis, Sinusitis, Icsol, Gliosis)

GRAPH NO. 1 TABLE SHOWING POSITIVE MRI FINDINGS IN DIFFERENT ETIOLOGICAL MENINGITIS

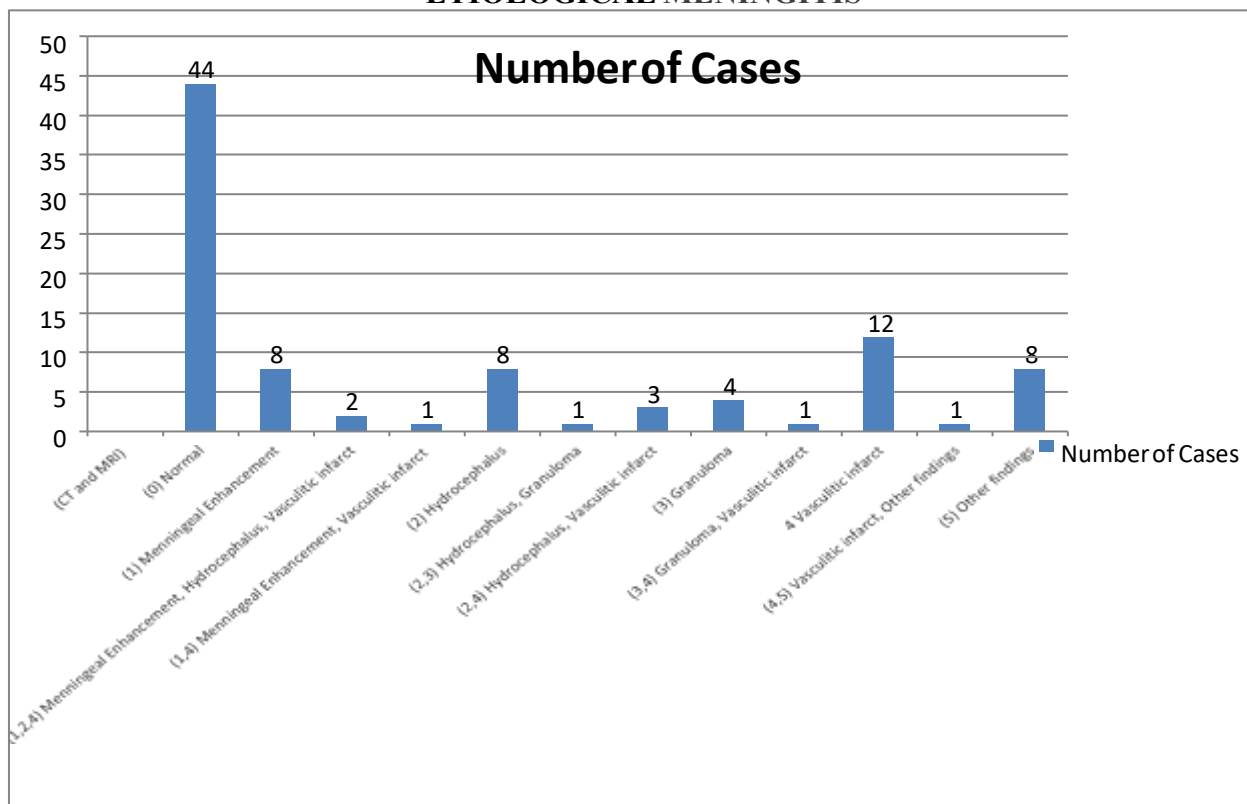


IMAGE NO-1 [35 YEAR MALE, CT[P] SUGGESTIVE OF COMMUNICATING HYDROCEPHALUS WITH INTRAVENTRICULAR SHUNT INSITU]

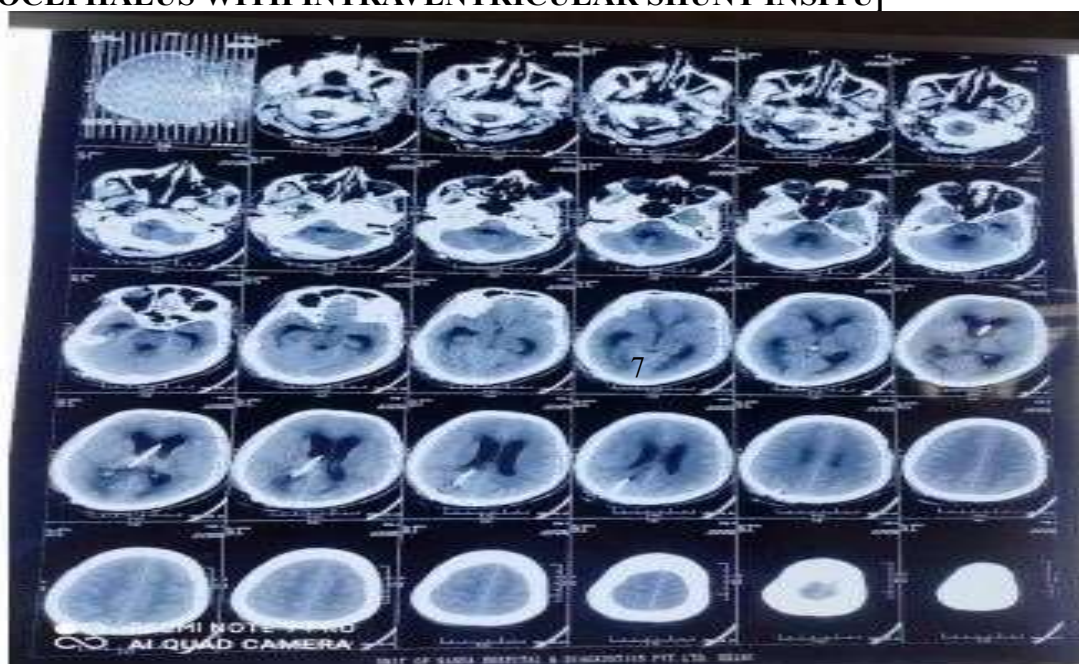


IMAGE NO-2 MRI BRAIN P+C (SUGGESTIVE OF INFECTIVE GRANULOMAS WITH POSSIBILITY OF OCCIPITAL TUBERCULOMAS)

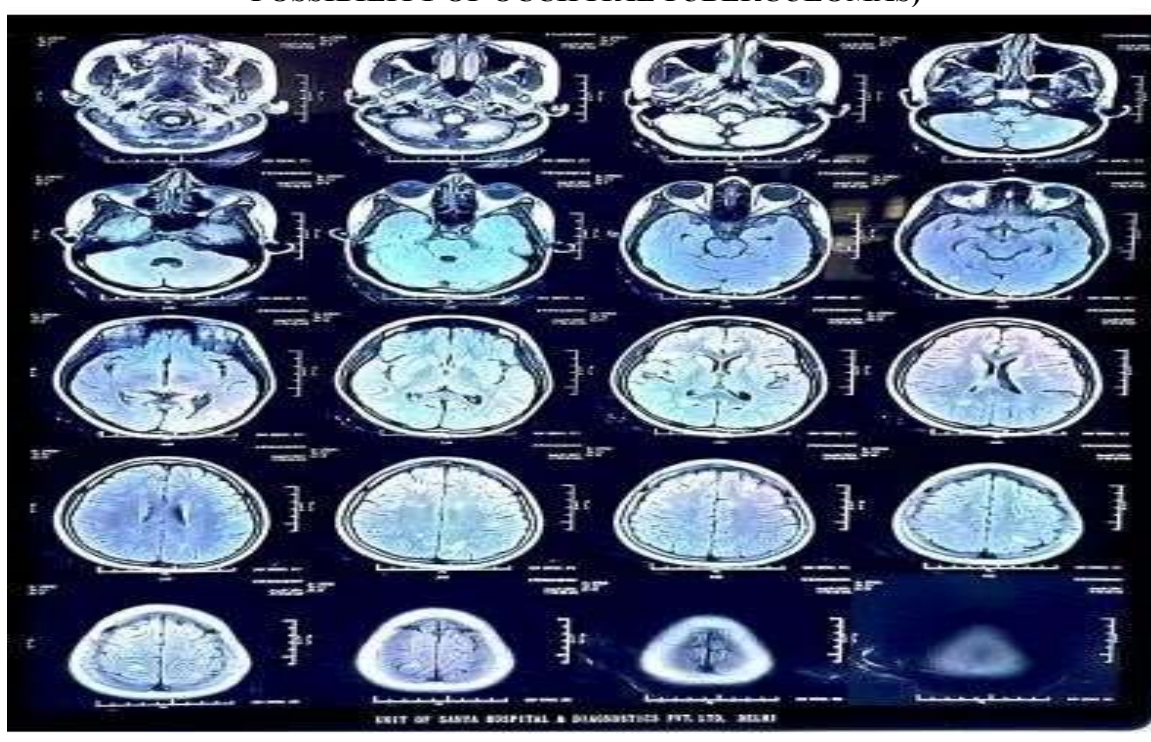
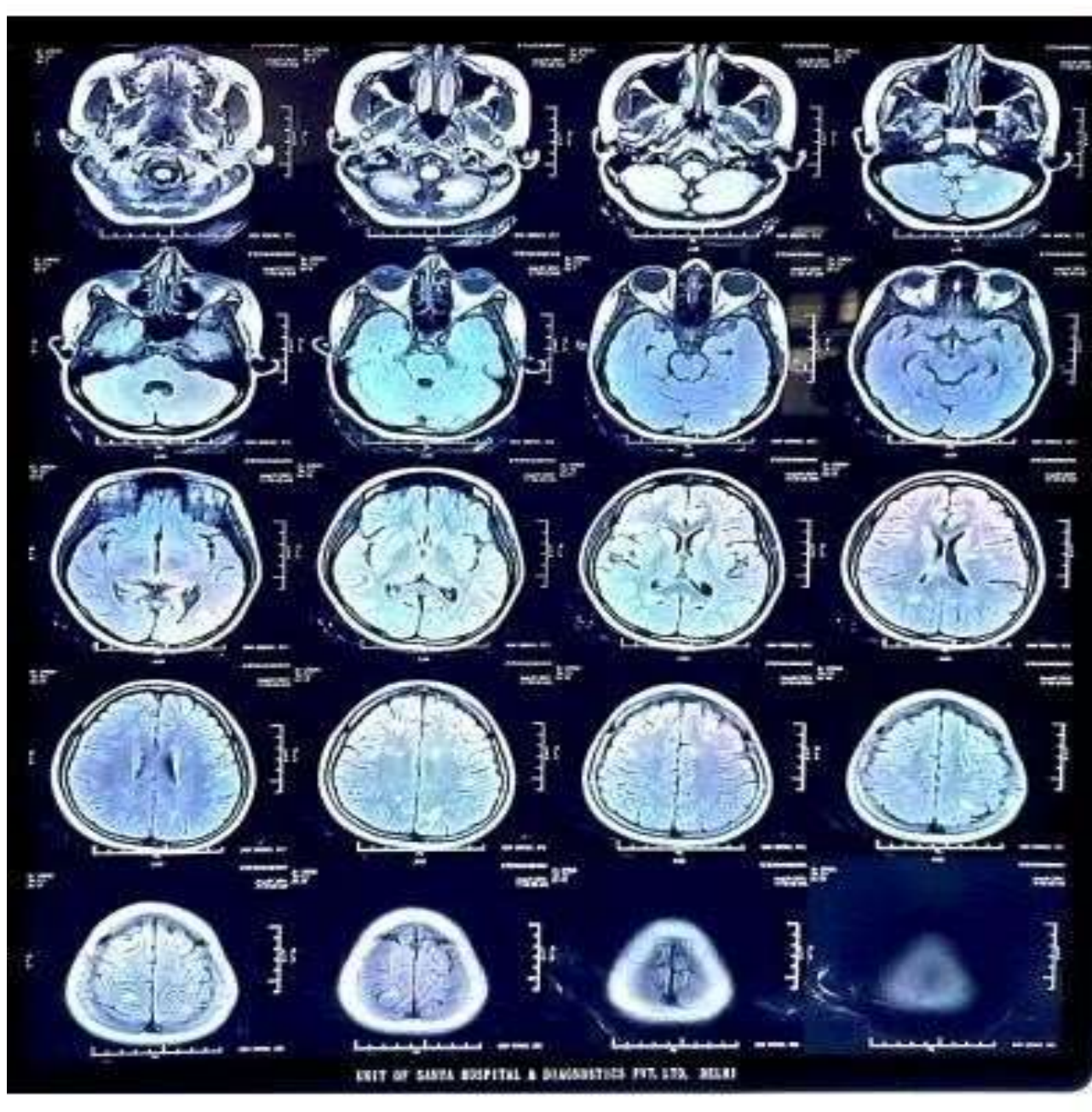


IMAGE NO-3 17 YEAR /FMRI BRAIN P+C (SUGGESTIVE OF INFECTIVE GRANULOMASWITH POSSIBILITY OF OCCIPITAL TUBERCULOMA



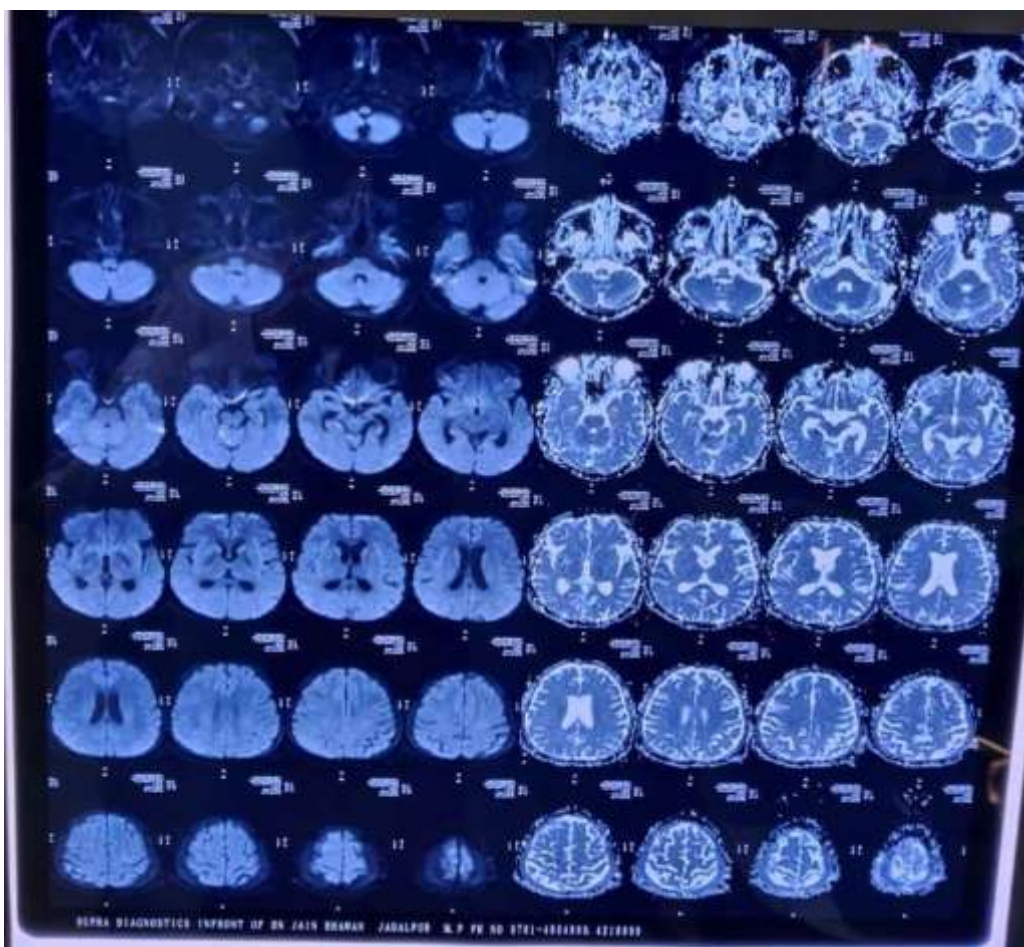


IMAGE NO-4 AGE 24 YEAR/F DWI SEQUENCE - SMALL FOCI OF RESTRICTED DIFFUSION ON DWI NOTED IN THE SUPERIOR RIGHT CEREBELLAR VERMIS, RIGHT PUTAMEN AND RIGHT MIDDLE TEMPORAL LOBE SUGGESTIVE OF MENINGITIS RELATED VASCULITIC INFARCTS

DISCUSSION

This is a prospective observational, single center study done in Department of medicine and radiology in MGM medical college and MY hospital Indore in 93 patients of acute meningoencephalitis cases from 1st March to 2021 to 1st March August 2023. The main aim of this study is “ CT and MRI in assessment of meningitis and meningo-encephalitis patients”after taking ethical clearance from Institutional Ethics Committee.

The mean age of the study participants was 35.37 years with maximum study participants i.e. 14 to 50 years of age and the most of the patient were male and young adults which is similar to the findings found in The Tamil Nadu Dr. MGR Medical University (prospective observational study) done in June 2014 – 2015²¹.

In our present study on the basis of Etiology Tubercular Meningitis was found most common over all cause, which was followed by Bacterial and viral Meningitis which is similar to the findings. found in The Tamil nadu Dr. MGR Medical University (prospective observational study) done in June 2014 – 2015²¹.

Among 93 patients, 37 patients were diagnosed as Tuberculous meningitis. 31 patients were diagnosed as pyogenic meningitis; 25 patients were diagnosed as viral meningoencephalitis. Thus, in comparison to the study done Tamil Nadu Dr. M.G.R Medical University, Chennai, and in the journal of the royal 2019 where a prospective study was done in the south Indian tertiary care center,²¹ my study also has male and young predominance and Tubercular meningitis was the most common cause found which was followed by Bacterial meningitis and then Viral meningitis. In case of clinical of profile Among the 93 patients with meningo-encephalitis in this study, the common initial presenting

symptoms were fever (89%) and Vomiting (89%) > altered sensorium > headache and neck pain and stiffness> Focal neurological deficit> seizure. Fever was the most common initial presenting symptom. 86 patients (92.5%) had fever and headache (92.5%).

Headache was associated with vomiting in some of the patients. 45 patients had both fever and headache. 58 patients had altered sensorium in the course of illness, varying from drowsiness to deep coma. Only 45 patients had all the three triad – headache, fever and altered sensorium. The similar finding was also found Tamil Nadu Dr. M.G.R Medical University, Chennai, and in the journal of the royal 2019 where a prospective study was done in the south Indian tertiary care center.²¹

Positive MRI and CT findings also added major contribution in differentiating the type of meningitis as well as prognosis of the disease. The most common radiological finding noticed in the study was vasculitic infarct followed by hydrocephalus followed by meningeal enhancement, granuloma and the other findings including (Thrombosis, Sinusitis, Icsol, Gliosis). Though they are not useful in the usual viral meningitis but may help to exclude other diagnosis. These Imaging is particularly helpful in later stage of TBM which shows basal enhancement and hydrocephalus. The similar findings were also noticed in the study done in Tamil Nadu Dr. M.G.R Medical University, Chennai, and in the journal of the royal 2019 where a prospective study was done in the south Indian tertiary care center.²¹ and Bhargava, S Gupta, AK tandon's study (Hydrocephalus caused by tuberculous meningitis: clinical picture, CT findings and results of shunt surgery) and a study done by K. Fatema 2020, by K H Chan 2005 (TBM – CT study 1992)

In our present study on the basis of Etiology Tubercular Meningitis was found most common over all cause, which was followed by Bacterial and viral Meningitis.

In case of bacterial meningitis In my study out of 93 patient, 31 patient was found as bacterial meningitis which had s-crp value mostly ranging between >24 mg/l, out of them 19 patient had s-crp value >48 mg/l (61.29%). Most of them had poor prognosis and presented with altered sensorium and high-grade fever and other focal neurological deficit and had radiological finding in the form of leptomeningeal enhancement and hydrocephalus followed by infarct in 3 cases. These 3 patients even died after few days of admission despite of giving empirical treatment. This shows Bacterial etiology is associated with high serum CRP level in comparison to viral meningitis, where out of 25 cases of viral meningitis 19 patient had significantly CRP value < 6 mg/l and 3 patients had between 6 – 12 mg/l which concludes that serum CRP level estimation can we very helpful in differentiating viral meningitis from bacterial.

Though in Tubercular meningitis most of the patient had serum CRP level in intermediate range except two patient who had serum CRP level more than 48 mg/l. These findings also found similar in the study of Konatham Rambabu Kathyayani M K M (The significance of serum c- reactive protein estimation in acute meningitis in adults), *Devanayagam et al* (1993) (Clinical epidemiology unit, Madras Medical college, Brown et al. (1978), D Diculencu²², E Miftode, T Turcu, D Buiuc (The value of C-reactive protein for the differentiation of bacterial meningitis from viral meningitis), José Diego Santotoribio , Juan Francisco Cuadros-Muñoz , Natalia García-Casares (Comparison of C Reactive Protein and Procalcitonin Levels in Cerebrospinal Fluid and Serum to Differentiate Bacterial from Viral Meningitis), Suchat Sirijaichingkul et al. (JMED association Thai 2005 sep.) also concluded that S-CRP can help in differentiating between bacterial and Aseptic Meningitis , Frizzo et al. Quad Sclavo Diagn. 1987, Lars-Olof Hansson , Gudmundur Axelsson , Tommy Linne ,Elisabeth Aurelius & Lars Lindquist Pages 625630 Published online: 08 Jul 2009 (Serum C-reactive Protein in the Differential Diagnosis of Acute Meningitis), R Mary et al. Ann Biol Clin (Paris) 2003 [Acute meningitidis, acute phase proteins and procalcitonin], J Sutinen et al. Infectious disease (Etiology of central nervous system infections in the Philippines and the role of serum C-reactive protein in excluding acute bacterial meningitis (1998 to 1999)

SUMMARY & CONCLUSION

In this study, most of the patients with meningoencephalitis were males and young adults. Surprisingly, Tuberculous meningitis was the most common overall cause in this study. This observation is in contrast to the Western literature. Viral etiology in the most common one in western

population. Both viral meningo-encephalitis and pyogenic meningitis constituted most of the cases of acute Meningoencephalitis. Tuberculous meningitis was the most common cause in patient with sub-acute meningitis. Diagnosis of tuberculous meningitis was challenging; clinical presentation, CSF studies and brain imaging features helped to make a diagnosis of tuberculous meningitis. Estimation of C-reactive protein in serum is the cheapest, sensitive and specific test to differentiate bacterial from viral infections.

The rapid differentiation facilitates an early, accurate and appropriate therapy thereby reducing the mortality and morbidity rates, the overall cost of the treatment and the duration of hospitalization. Serum CRP can be used as the best and most sensitive bedside prognostic indicator of bacterial infections. Meningeal infections have a definite male predominance. Altered level of consciousness at the time of admission is associated with bad prognosis and high case fatality rate (28%). Among the 93 patients with meningoencephalitis in this study, the common initial presenting symptoms were fever (89%) and Vomiting (89%) > altered sensorium> headache and neck pain and stiffness>Focal neurological deficit> seizure. Fever was the most common initial presenting symptom. 86 patients (92.5%) had fever and headache (92.5%). On investigation we found that 0 = Normal, 1 = Meningeal Enhancement, 2 = Hydrocephalus, 3 = Granuloma, 4= Vasculitic infarct, 5 = Other findings (Thrombosis, Sinusitis, Icsol, Gliosis) found.

BIBLIOGRAPHY

1. Ginsberg L, Kidd D. Chronic and recurrent meningitis. *Pract Neurol*. Dec 2008;8(6):348-61.
2. Berkhout B. Infectious diseases of the nervous system: pathogenesis and worldwide impact. *I Drugs*. Nov 2008;11(11):791-5.
3. Moses S. Meningitis: Acute bacterial meningitis. <http://www.fpnotebook.com/neuro/ID/Mngts.htm>.
4. Rich AR, McCordick HA. The pathogenesis of tuberculous meningitis. *Bulletin of John Hopkins Hospital*. 1933;52:5-37.
5. World Health Organization. Tuberculosis. World Health Organization. <http://www.who.int/mediacentre/factsheets/fs104/en/>.
6. Landry ML, Greenwold J, Vikram HR. Herpes simplex type-2 meningitis: presentation and lack of standardized therapy. *Am J Med*. Jul 2009;122(7):688-91.
7. Saag MS, Graybill RJ, Larsen RA, Pappas PG, Perfect JR, Powderly WG, et al. Practice guidelines for the management of cryptococcal disease. *Infectious Diseases Society of America. Clin Infect Dis*. Apr 2000;30(4):710-8.
8. Bloch KC, Glaser C. Diagnostic approaches for patients with suspected encephalitis. *Curr Infect Dis Rep*. Jul 2007;9(4):315-22.
9. Quagliarello VJ, Scheld WM. Treatment of bacterial meningitis. *N Engl J Med*. 1997 Mar 6;336(10):708-16.
10. Aronin SI, Peduzzi P, Quagliarello VJ. Community-acquired bacterial meningitis: risk stratification for adverse clinical outcome and effect of antibiotic timing. *Ann Intern Med*. 1998 Dec 1;129(11):862-9.
11. Mace SE. Acute bacterial meningitis. *Emerg Med Clin North Am*. 200 May;26(2):281-317, viii. doi: 10.1016/j.emc.2008.02.002. Review.
12. Roos KL, van de Beek D. Bacterial meningitis. *Handb Clin Neurol*. 2010;96:51-63. doi: 10.1016/S0072-9752(09)96004-3. Epub 2010 Jan 19.
13. Fitch MT, Abrahamian FM, Moran GJ, Talan DA. Emergency department management of meningitis and encephalitis. *Infect Dis Clin North Am*. 2008 Mar;22(1):33-52, v-vi. doi: 10.1016/j.idc.2007.10.001. Review.
14. Rugman S, Katz SI, Cerston AA, Wilfert E. Aseptic Meningitis in *Infectious Diseases of Children*. 8th edn. CV Mosby Co, Toronto, 1985: 167-173.
15. Hammer SM, Connolly KJ. Viral aseptic meningitis in the United States: Clinical features, viral etiologies and differential diagnosis. *Clin Top Infect Dis* 1992; 12: 1-25. *Centre for Disease Control Morbidity & Mortality Weekly Report* 2003; 52 (32); 761-764.

16. Tee WS, Choong CT, Iui RV, Ling AE. Aseptic meningitis in children: The Singapore experience. *Ann Acad Med Singapore* 2002; 31 (6); 756-760.
17. Rotbart HP. Enteroviral infections of the central nervous system. *Clin Infect Dis* 1995; 20(4); 971-981
18. Connolly KJ, Hammer SM. The acute aseptic meningitis syndrome. *Infect Dis Clin North Am* 1990; 4(4); 599-622.
19. Dalton M, Newton RW. Aseptic meningitis. *Dev Med Child Neurol* 1991; 33(5); 446-451
20. Deivanayagam, N., et al; Clinical Epidemiology Unit, Madras Medical College, India. Evaluation of CSF variables as a diagnostic test for bacterial meningitis. *J Trop Pediatr* 1993 Oct; 39 (5); 284-7.
21. Diculencu D, Miftode E, Turcu T, Buiac D. The value of C-reactive protein for the differentiation of bacterial meningitis from viral meningitis, *Rev Med chiv soc Med Nat lasi*, 1995 jan-june, 99 (1-2): 144-50.
22. Aehar, S.T. RamaRao G et al; Meningitis in Infancy and child hood other than tuberculous meningitis, *Indian J. Pediatr* 2953; 20; 55-59.
23. Brown, R.L. Zinner, S.H. Meglio, F.D. et al: Counter-current immunoelectrophoresis in the diagnosis of viral infections of the central nervous system *J. Infect Dis.*, 138; 911-9, 1978.
24. Benjamin. D.R. Opheim, K.E: is CRP useful in the management of children with suspected bacterial meningitis-*Am J Clin Pathol* 1984; 81; 779-782.
25. Bohr, V., et al; Diagnostic procedures and the impact of preadmission antibiotic therapy *J. Infect* 1983; 7; 193-202.
26. Briem M-H., et al; Creatine Kinase isoenzyme BB in CSF from patients with meningitis and encephalitis. *J infect Dis* 148; 180, 1983.
27. Brown, K G E; Meningitis in Queen Elizabeth Central Hospital Balantyre, Malawi. *East Afr. Med J* 1975; 52: 376-3, 9.
28. Carl-Bortil Laurell-Acute phase proteins a group of protective proteins – Recent advances in *Clinical Biochemistry-1985.*, 118., *J. Infect. Dis* 151: 854, 1 1985.
29. Choi, C.; Bacterial Meningitis in St. Mary’s Medical Center, Long beach, California, *Clin Geriatr Med* 1992 Nov; 8(4): 889-902, 1992. 54.