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Review Article

Neurological infections in the elderly

Imran Rizvi[1], Ravindra Kumar Garg[2]

The elderly is predisposed to develop neurological infections due to immunosenescence and other co-morbidities. Bacterial meningitis in the elderly is most commonly caused by Streptococcus pneumoniae, Listeria monocytogenes must always be considered when dealing with bacterial meningitis in the elderly. The elderly patients with bacterial meningitis requires empiric treatment with third generation cephalosporin plus vancomycin and ampicillin. The elderly is also at greater risk of developing tuberculosis and tuberculous meningitis. The tuberculous meningitis in elderly can present with atypical clinical features. Cerebrospinal fluid may not show pleocytosis in elderly patients with tuberculous meningitis. The elderly tuberculous meningitis patients are also more prone to develop hepatotoxicity after initiation of antituberculosis treatment. Elderly persons are also at increased risk of fungal infections of the nervous system, cryptococcal meningitis being most common of them. The treatment of cryptococcal meningitis in elderly is complicated by the fact that amphotericin B is a potentially nephrotoxic drug; elderly patients should be well hydrated while being treated with amphotericin B. Common viral infections of nervous system seen in elderly are herpes simplex encephalitis, varicella zoster encephalitis and arboviral encephalitis. Viral encephalitis in elderly carries poor prognosis as compared to the younger patients. Toxic/ metabolic encephalopathy is a close differential diagnosis.

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Key words **: Elderly, bacterial meningitis, tuberculous meningitis, cryptococcal meningitis, viral encephalitis.**

The elderly population is increasing across the world as a result of improved life expectancy. The elderly people are predisposed to the development of central nervous system infections. Many problems are encountered in the management of these patients. The classical signs and symptoms of a neurological infection might be lacking in this population. The possible causative organisms might be different in the elderly. Presence of associated co-morbidities like diabetes, chronic kidney, liver and lung and heart disease poses a further challenge in managing such patients. The predominant symptom of such infections is altered level of consciousness, which can be present in a variety of non-infectious processes like electrolyte imbalances, hepatic and renal disorders and hyper or hypoglycaemia. The elderly is at high risk of mortality and morbidity; therefore, prompt recognition and management of such infections is needed. This article will highlight the various issues involved in the diagnosis and management of common neurological infections in the elderly people.

Metabolic encephalopathy which is extremely common in elderly population. In metabolic encephalopathy, there is an acute global brain dysfunction in the absence of apparent structural brain disease. Metabolic encephalopathies, usually are reversible if the systemic disorder is promptly treated. Metabolic encephalopathy often presents with confusion and delirium. Confusion is characterized by the patient's inability to have a consistent coherent stream of thought and/or action. Delirium is characterized with aconfusionthat is associated with hyperactivity of the autonomic nervous system. Many central nervous system infections, like bacterial meningitis, in elderly present with confusion and delirium and pose diagnostic challenge.

Editorial Comments :
- **Becterial meningitis in elderly often caused by streptococcus pneumoniae, listeria monocytogenes.**
- **Tuberculous meningitis also common in elderly and often having atypical feature.**
- **Viral encephalitis have poor prognosis in elderly.**
- **Fungal meningitis in immuno compromised host.**
- **Toxic, metabolic encephalopathy also should need attention in elderly.**

Acute Bacterial Meningitis in the Elderly :

Bacterial meningitis is defined as the purulent infection of the pia and arachnoid and cerebrospinal fluid of the subarachnoid space. The epidemiology, clinical features and prognosis of bacterial meningitis in elderly patients is different as compared to the younger population[1]. The epidemiology of bacterial meningitis had changed in the recent years, probably due to widespread use of vaccination; because of this epidemiological change bacterial meningitis is now mainly the disease of adults[2]. In the de-

Department of neurology, King George Medical University, Lucknow 226003
[1]MBBS, DM (Neuro) Assistant Professor
[2]MBBS, DM (Neuro) Professor and Head and corresponding author

veloped countries the estimated incidence of bacterial meningitis is around 0.6-4 per 100 000 adults per year; but it can be many times higher in other parts of the world[3,4,5]. Due to widespread immunization against Haemophilus influenzae type b and Streptococcus pneumoniae the burden of meningitis due to these organisms had decreased in childhood[6,7]. These organisms are now more commonly implicated for causing meningitis in the older adults. A comprehensive survey from the United states had shown that approximately 20% of Haemophilus influenzae meningitis were projected to involve patients of more than 60 years of age as compared to the 1986 survey which showed only 8.6% of older adults to be suffering from Haemophilus influenzae meningitis[3].

Overall the common bacteria involved in causing bacterial meningitis in elderly are Streptococcus pneumoniae, Listeria monocytogenes, Neisseria meningitidis, gram negative bacilli like Escherichia coli and Klebsiella pneumoniae; Streptococcus agalactiae and Haemophilus influenzae[2,8,9].

The common risk factors for development of bacterial meningitis are pneumonia, sinusitis, otitis media, alcoholism, diabetes mellitus, splenectomy, urinary tract infections, cirrhosis, renal failure, head injury and neurosurgical procedures. Old age (>60 years) is itself a risk factor for developing Listeria monocytogenes meningitis. Cabellos and co-workers noted that elderly had a higher frequency of pneumonia and otitis, diabetes and neoplasm as underlying disease[8].

The common symptoms of bacterial meningitis are fever, headache, vomiting, altered sensorium, neck stiffness, seizures, focal deficits; although none of the symptoms are specific for bacterial meningitis. A "classical clinical triad"of bacterial meningitis had been described which include fever, neck stiffness and alteration of mental status. Recent studies have found this "classical triad" to be present in only 44% of patients with bacterial meningitis. However about 95% of patients had 2 of the 4 features of headache, fever, neck stiffness, and altered mental status[10]. Elderly patients poses a special diagnostic challenge as they may not show the classic clinical features of bacterial meningitis. As compared to the younger patients older patients with bacterial meningitis more often present with an altered sensorium and focal deficits; while headache and neck stiffness are less frequent in the elderly patients with bacterial meningitis[8,9,11].

The signs to be elicited in patients of bacterial meningitis are nuchal rigidity, Kernig's sign and Brudzinski's sign. Kernig's sign is elicited by flexing the hip and extending the knee; a Kernig's sign is said to be positive when such manoeuvre elicits pain in the back and legs. Brudzinski's sign is said to be positive when passive flexion of neck in supine position leads to flexion of hip joints. A prospective study done on 297 adults found that none of these signs have very good diagnostic accuracy[12].

The diagnosis of bacterial meningitis is usually made by the examination of cerebrospinal fluid (CSF). Whether to perform a neuroimaging (CT or MRI) before performing a lumbar puncture is a frequent issue faced by the treating physicians[13]. Situations where it is reasonable to perform a CT scan before performing lumbar puncture are summarized in Box-1[13].

The typical CSF findings in bacterial meningitis are raised CSF protein, low CSF sugar (<40mg/dl; CSF glucose/blood glucose <0.4) and polymorphonuclear pleocytosis. Gram staining of CSF is also useful in diagnosis of bacterial meningitis; CSF gram staining have a reported sensitivity of 50-90%, but the specificity is 100% in making the diagnosis of bacterial meningitis[4,10]. CSF culture remains the "gold standard" for the diagnosis of bacterial meningitis[14]. The sensitivity of CSF culture varies from 25% to 90% depending upon the causative bacteria. The diagnostic yield of CSF culture decreases if the patient had already received antibiotic treatment.

Latex agglutination test is another test which can be useful in etiological diagnosis of bacterial meningitis, the main advantage of latex agglutination test is that it can give result within 15 minutes[14]. However, latex agglutination testing quickly turns negative if the patient receives antibiotics[15]. Nucleic acid amplification tests, such as polymerase chain reaction (PCR), can detect bacterial DNA in CSF[14]. Skin biopsy followed by gram staining and culture of skin lesions can be useful in diagnosis of meningococcal meningitis[14]. Blood culture is also useful in isolating the organism, the sensitivity of blood culture depends upon the causative organism, the yield of blood culture also reduce if the patient receive pre-treatment with antibiotics[14].

Bacterial meningitis in the elderly needs to be differentiated from many infective and non-infective etiologies. The common differential diagnosis includes metabolic encephalopathies due to electrolyte imbalance, uraemia, hepatic encephalopathy; septic encephalopathy and carcinomatous meningitis. The diagnosis of metabolic encephalopathy requires evaluation of arterial blood gas analysis, blood biochemistry, electroencephalography, neuroimaging (Table 2).

Bacterial meningitis is a medical emergency and em-

Table 1 — *Indications for performing CT scan before lumber puncture in patients of suspected bacterial meningitis*

(1) New onset seizure
(2) Presence of an immunocompromised state
(3) Presence papilledema
(4) Presence of focal neurological deficits
(5) Moderate to severe impairment of consciousness
(6) Recent head trauma

Table 2 — *Differential diagnosis of bacterial meningitis with carcinomatous meningitis and septic encephalopathy*

Characteristics	Bacterial meningitis	Carcinomatous meningitis	Septic/metabolic encephalopathy
Clinical features	Headache Fever Neck stiffness Altered sensorium Seizures Focal deficits	Headache Altered sensorium Cranial nerve involvement and myeloradiculopathy	Confusion and delirium and absence of focal deficits Myoclonus and asterixis.
Co-morbidities	Otitis media Sinusitis Pneumonia Immunocompromised states alcoholism	Malignancies like lung, breast, lymphoma, leukaemia	Sepsis like pneumonia, urinary tract infection may be present. Blood biochemistry is often abnormal.
CSF examination	Protein: raised Sugar: low polymorphonuclear pleocytosis Gram staining and culture may identify organism.	Protein is commonly raised Sugar is reduced TLC can be raised in about 2/3 of patients. Malignant cells can be seen in CSF.	CSF analysis is usually normal
Neuroimaging	Meningeal enhancement. Subdural empyema Abscess formation Sinusitis Mastoiditis Hydrocephalous	Leptomeningeal enhancement Brain and spinal cord metastasis	Usually normal

CSF = cerebrospinal fluid; TLC= total leukocyte count

pirical antibiotic therapy should be started as soon as possible[16,17]. The empirical therapy can be changed according the reports of culture and sensitivity, once they are available[16,17]. The empirical therapy includes a third generation cephalosporin (cefotaxime or ceftriaxone) along with vancomycin[16,17]. The elderly patients should also receive ampicillin, for additional coverage of Listeria monocytogenes[16,17]. Patients of bacterial meningitis should also receive intravenous dexamethasone along with the first dose of antibiotics. A recent metaanalysis showed that use of adjunctive dexamethasone in patients of bacterial meningitis led to reduction in mortality and neurological sequelae[18]. The dosage and route of administration of drugs used for empirical therapy of bacterial meningitis in elderly is summarized in Table 3, Fig 1.

SinceStreptococcus pneumoniae is the most common causative organism responsible for bacterial meningitis; prevention of this form of meningitis appears to be most reasonable. Vaccines are available against Streptococcus pneumoniae, these vaccines are shown to be partially effective in prevention of invasive form of disease including meningitis. Pneumococcal vaccines are also safe and well tolerated. The centre for disease control USA recommends pneumococcal vaccine for all adults 65 years or older.

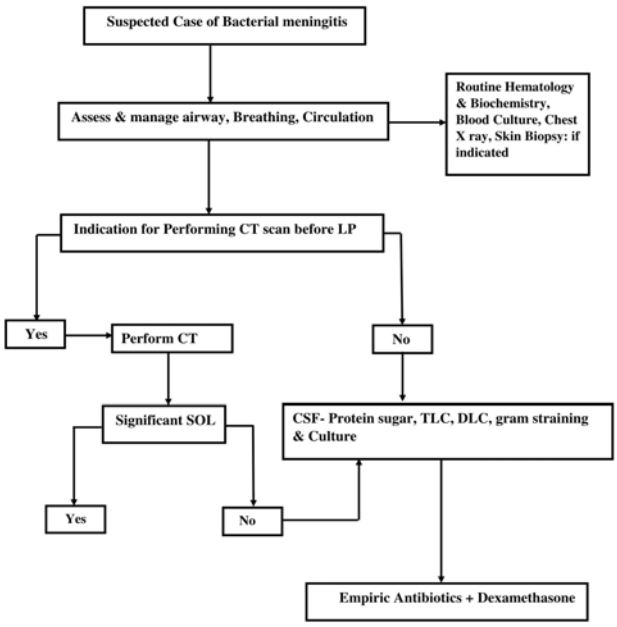
Tuberculous Meningitis in the Elderly :

The elderly people are susceptible to develop tuberculosis as well[19]. The 2010 global burden of tuberculosis shows that about 57% of all tuberculosis related deaths occurred among people who are older than 50 years, and half of these deaths occurred in those who were aged more than 65 years[20]. Older patients are more likely to develop extra-pulmonary tuberculosis, like meningitis[21-23]. The exact burden of tuberculous meningitis in elderly is not clearly mentioned in the literature, but it is known that the incidence of tuberculous meningitis is proportional to the total tuberculosis burden in the community. The diagnosis of tuberculous meningitis might be difficult in the elderly as typical clinical features might not be always present in this age group[24]. The management of tuberculosis in this age group is further complicated by the fact that these patients have a higher chances of developing drug related adverse effects[21]. Old age is also a prognostic factors for patients with tuberculous meningitis, and older age was found to be associated with poor outcome in a Chinese cohort[25].

There can be a prodromal stage when the patient experience non-specific symptoms like anorexia, malaise, fatigue and fever. The signs of meningeal irritation can be absent during this prodromal stage. Eventually headache worsens and patient develop other complications like altered sensorium, focal deficits, coma and death if treatment is not administered. Amongst the various clinical features fever is the most common symptom seen in 60-95% of patients, headache is seen in only 50-80% patients, Neck stiffness is only seen in 40-80% of patients[26-30]. Cranial nerve palsies and other focal deficits like hemiparesis, monoparesis and hemiparesis are seen at varying frequencies. Cranial nerve VI is the most commonly involved cranial nerve[26-30]. Atypical presentations of tuberculous meningitis in the form of acute illness and confu-

Table 3 — *Initial empiric antibiotic and adjuvant therapy in elderly patients with bacterial meningitis*[14,17,18]

Empiric Antimicrobial agents
Ceftriaxone : 2gm intravenously every 12 hourly
OR
Cefotaxime : 2gm intravenously every 8 hourly
Plus
Vancomycin : 1 gm intravenously every 12 hourly
Plus
Ampicillin : 12 gm/day intravenously divided every 4 hourly
Adjuvant therapy
Dexamethasone : 10mg intravenously every 6 hourly for 4 days (to be given along with or just before first dose of antibiotic)



CT- Computed Tomography, LP- Lumber Puncher, SOL- Space Occupying Lesion, CSF- Cerebrospinal Fluid, TLC- Total Leucocyte Count, DLC- Differential Leucocyte Count

Fig 1 — Algorithm for the management of bacterial meningitis

sional state had been described in the elderly patients[24].

Patients of tuberculous meningitis can develop various complications like development of hydrocephalous, optochiasmatic arachnoiditis, strokes and tuberculoma formation. Optochiasmatic arachnoiditis develops as a result of thick exudates in the inter-peduncular and suprasellar cisterns; it presents with vision loss. Strokes develops as a result of thick exudates around the circle of Willis, it presents with focal deficits like hemiparesis.

Common CSF findings in patients of tuberculous meningitis are an elevation of protein, a reduction in CSF sugar. CSF sugar levels are usually found to be <50% in patients of tuberculous meningitis. CSF cell count is moderate increased and a lymphocytic pleocytosis is commonly seen. However, a normal total white blood cell count can be seen in CSF of tuberculous meningitis in presence of depressed cellular immunity like elderly and human immunodeficiency virus (HIV) infected individuals[31,32]. Ziehl-Neelsen staining of CSF for the identification of acid fast bacilli is a useful technique for definite diagnosis of tuberculous meningitis, however diagnostic yield of microscopy is usually poor. Culture of CSF for mycobacterium can also establish a definite diagnosis of tuberculous meningitis; however, culture is a time taking process and yield is usually low. Nucleic acid amplification techniques are currently being utilized for diagnosis of tuberculous meningitis. The GeneXpert MTB/RIF test is based on polymerase chain reaction, this test can identify mycobacterium tuberculosis complex in a few hours, this test can also detect rifampicin resistance[33].

Elderly patients with tuberculosis show a higher frequencies of abnormal liver enzymes, hypoalbuminaemia, dyselectrolytemia and normocytic normochromic anaemia as compared to the younger patients[35].

Neuroimaging is also frequently utilized in the diagnosis of tuberculous meningitis. Magnetic resonance imaging (MRI) is considered superior to computed tomography (CT)of brain in the diagnosis of tuberculous meningitis. Neuroimaging can be normal early in the course of tuberculous meningitis. The common radiological findings seen in patients of tuberculous meningitis are leptomeningeal enhancement, hydrocephalous, basal exudates, peri-ventricular infarcts and tuberculomas[34]. MRI findings from a case of tuberculous meningitis are shown in Fig 2.

Management of tuberculous meningitis in the elderly follows the same principles that are utilized in the treatment of younger patients, however several issues need special mention. Due to age related physiological changes, co-morbidities and polypharmacy elderly patients are at higher risk of developing adverse drug reactions. Hepatotoxicity is a common adverse effect of all the four first line anti tuberculosis drugs, the spectrum of hepatotoxicity ranges from asymptomatic elevation of liver enzymes to hepatic failure. Hepatotoxicity from antituberculosis drugs increases significantly with age[36]. Elderly patients are also at a greater risk of developing acute kidney injury[37], streptomycin is used frequently in the treatment of tuberculous meningitis which can further increase the risk of nephrotoxicity.

With this background in mind we further discuss the treatment of tuberculous meningitis. The most important principle of treatment of tuberculous meningitis is start antituberculosis treatment as soon as possible. According to the recommendations of World Health Organization patients of tuberculous meningitis should receive 4 drugs isoniazid, rifampicin pyrizinamide and intramuscular streptomycin for 2 months followed by isoniazid and rifampicin for 10 months[38]. Some authorities use ethambutol instead of streptomycin. Ethambutol has the potential to cause optic neuropathy on the other hand streptomycin can cause nephrotoxicity.

Apart from anti tuberculosis drugs all patients of tuberculous meningitis should be given corticosteroids irrespective of the age[39]. Dexamethasone is commonly used and it is given for a period of 8 weeks in tapering doses. Adjunctive corticosteroids reduces the risk of death in tuberculous meningitis[40](Table 4).

Fungal Meningitis in the Elderly :

Invasive fungal infections like meningitis are increasingly becoming a problem in the elderly. The opportunis-

Table 4 — *Treatment of tuberculous meningitis*

Anti tuberculosis drugs
Isoniazid (H) : 5 mg/kg/day oral; maximum 300mg
Rifampicin (R) : 10 mg/kg/day oral; maximum 600mg
Pyrizinamide (Z) : 25 mg/kg/day oral; maximum 2000 mg
Streptomycin (S) : 20 mg/kg/day intramuscular; maximum 1000 mg
OR
Ethambutol (E) : 15 mg/kg/day oral; maximum 1200 mg
Adjuvant therapy
Dexamethasone : 0.4 mg/kg/day weight intravenous and then tapered off decreasing 0.1 mg/kg every week; oral dexamethasone should be given for the next 4 weeks (starting at a total of 4 mg per day and decreasing by 1 mg each week)

tic fungal infections are becoming commoner in older patients because older patients are frequently receiving organ transplants, andimmunosuppressive treatment for rheumatological conditions[41]. Although most of the clinical features of fungal meningitis in the elderly are similar to the younger patients, there can be atypical manifestations in the elderly. Amphotericin B is the mainstay of treatment for fungal meningitis; but its use can be difficult in the elderly because of the intrinsic nephrotoxicity associated with this drug[41].

Fungal infections of the central nervous system can present in a variety of ways including meningitis, encephalitis, space occupying lesions, cranial neuropathies, vascular and spinal cord syndromes. Fungal meningitis is the most common manifestation among them. Cryptococcus, Coccidioides, Blastomyces, Paracoccidioides, Sporotrichum, Histoplasma and Candida are the most common fungi causing fungal meningitis[42].

The common clinical features of fungal meningitis are fever, headache, altered sensorium, seizures, cranial neuropathies and personality changes[42]. Elderly patients with cryptococcal meningitis can present with dementia; fever, headache and other typical features of meningitis might be absent in these elderly patients. Elderly patients with cryptococcal meningitis are more likely to experience a poor outcome[43].

A CSF examination is usually required for making a diagnosis of fungal meningitis. CSF protein is usually elevated and CSF sugar is low. CSF examination classically shows lymphocytic or monocytic pleocytosis. Aspergillus and Blastomyces meningitis can show neutrophilic predominance. Coccidiomycosis infection causes CSF eosinophilia[44]. India ink preparation or fungal culture can be used for demonstration of organisms; but they usually require large volume of CSF to do so. The cryptococcal polysaccharide antigen detection test has got good sensitivity and specificity. The CSF complement fixation antibody test has a reported sensitivity of 75% and specificity of 100% for Coccidiomycosis meningitis[45].

MRI is considered better than CT scan for the imaging of fungal meningitis. MRI findings seen in fungal meningitis include meningeal enhancement, punctate non-enhancing foci of CSF density around the basal ganglia (indicate presence of Cryptococcus in the Virchow-Robin spaces) pseudo cyst formation, cryptococcomas, hydrocephalous, abscess, and cerebral atrophy[46].

The antifungal therapy for patients with cryptococcal meningitis is divided into an induction phase and a consolidation phase. The induction phase involves giving intravenous Amphotericin B 0.7-1.0 mg/kg per day intravenously for at least 4 weeks plus Flucytosine 100 mg/kg per day orally in 4 divided doses for 4 weeks; therapy can be prolonged for 6 weeks in case of neurological complications. The consolidation phase involves giving fluconazole 400mg/day for 8 weeks[42].

Amphotericin B is intrinsically nephrotoxic. A rise in the serum creatinine level is usually seen by the second week of therapy; some older patients can develop acute kidney injury following a just a few doses of amphotericin B. Nephrotoxicity of amphotericin B is further aggravated if the patient is volume and sodium depleted. Proper hydration should be maintained and sodium loading should be considered in elderly patients who are receiving amphotericin B[41]. Amphotericin B can also lead to hypokalemia and hypomagnesaemia; therefore frequent monitoring of electrolytes should be done in elderly patients receiving amphotericin B. Older patients who develop nephrotoxicity require lipid formulations of amphotericin B for treatment.

Viral Encephalitis in the Elderly :

Adults aged more than 65 years with encephalitis are at a greater risk of hospitalization are poor outcome, including death and disability as compared to the general population[47]. A large variety of viruses are responsible for causing encephalitis. The most common viruses responsible for causing encephalitis in old age are herpes simplex virus, varicella-zoster virus and arboviruses. Herpes simplex virus 1 is commonly responsible for causing encephalitis, on the other hand herpes simplex encephalitis 2 is responsible for causing meningitis. Herpes simplex virus is the most common cause of sporadic encephalitis in the united states[47]. The Varicella zoster virus is also amongst the common causes of encephalitis in the adults[48-50]. The Varicella zoster encephalitis seen in patients older than 60 years is commonly due to viral reactivation, central nervous system vasculopathy is seen commonly in association with varicella zoster encephalitis[51]. Arboviruses are responsible for epidemic encephalitis which are usually transmitted through the bite of infected culex mosquito. Amongst the various arboviruses Japanese encephalitis virus is the most common cause of encephalitis in Asia. Children as well as elderly are at in-

creased risk of developing Japanese encephalitis[52]. In the recent years few developed Asian countries have experienced a change in the epidemiology of Japanese encephalitis and now elderly people are considered at increased risk of developing Japanese encephalitis in Taiwan, Japan and Korea[53]. In the western countries West Nile virus, Eastern equine encephalitis virus, Saint Louis encephalitisvirus, and La Crosse virus are common arboviruses leading to viral encephalitis.

Most viral encephalitis shows clinical features suggestive of brain parenchymal involvement as well as features suggestive of meningeal involvement. The common clinical features of herpes simplex encephalitis include acute onset of fever, headache, altered mental status, seizures, focal neurological deficits like hemiparesis, and coma[54]. Pathologically herpes simplex virus shows a predilection for the involvement of fronto-temporal, cingulate and insular cortex. Involvement of these regions of brain lead to personality and behaviour changes, recent memory impairment and amnesia, anomia and language impairment[54].

Varicella zoster encephalitis can present with or without evidence of primary infection. Three types of presentations are described in relation to varicella zoster encephalitis namely a post-infectious demyelinating syndrome, vasculopathy which can manifest as acute ischemic stroke and acute infectious encephalitis which presents as fever, headache, altered sensorium and seizures[55,56].

Most of Japanese encephalitis virus infections in the humans are asymptomatic. Symptomatic illness ranges from non-specific febrile illness to severe encephalitis. Patients develop a prodromal illness characterized by fever, chills, malaise, and abdominal symptoms; this is followed by the stage of encephalitis which is characterized by altered sensorium, seizures, focal deficits and coma[57]. After recovering from coma patients may develop movement disorders in the form of parkinsonism, dystonia and tremors[57].

The CSF examination in patients of viral encephalitis usually shows a moderate increase in protein, sugar levels are normal and moderate lymphocytic pleocytosis can be seen. Sometimes red blood cells can be seen in CSF of herpes simplex encephalitis. CSF polymerase chain reaction is very useful to establish the diagnosis of herpes simplex encephalitis, it carries a sensitivity of about 90% and specificity of about 100%. For the diagnosis of Japanese encephalitis IgM capture enzyme linked immunosorbent assay to detect antibodies in CSF has high sensitivity and specificity.Electroencephalogram in patients of herpes simplex encephalitis may show period temporal discharges which are repetitive at regular interval of 2 to 3 seconds.

MRI brain is the neuroimaging modality of choice for evaluation of viral encephalitis. Typical MRI findings in a

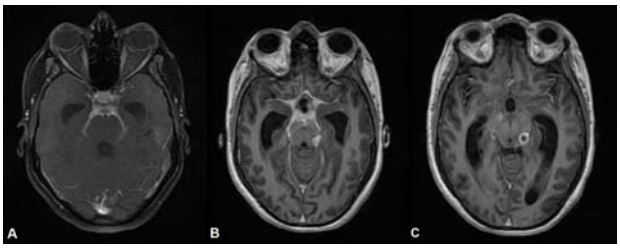


Fig 2 — Typical MRI findings in tuberculous meningitis (A) Post contrast T1 image showing hydrocephalous and basal meningeal enhancement (B) Post contrast Spoiled Gradient Recalled(SPGR) image showing basal exudates along with hydrocephalous (C) Post contrast SPGR image showing ring enhancing lesion suggestive of tuberculoma

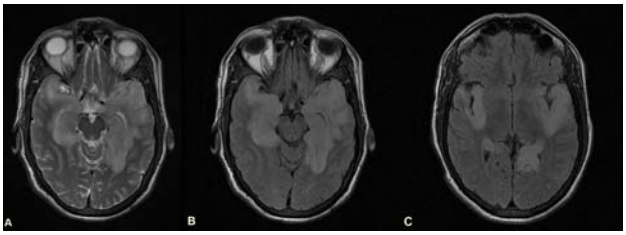


Fig 3 — Typical MRI findings from a case of herpes simplex encephalitis Hyperintensity involving bilateral medial temporal lobe (A & B) and insular cortex (C)

case of herpes simplex encephalitis are T2 and FLAIR hyper intensities involving the medial aspects of thetemporal lobes, orbital surfaces of the frontal lobes, insularcortex, and cingulate gyrus[54]. MRI findings from a case of herpes simplex encephalitis are shown in Fig 3. In patients of Japanese encephalitis, the MRI brain shows signal intensity changes in thalamus, basal ganglia, cerebellum, pons, substantia nigra, and cerebral cortex.

All suspected cases of herpes simplex encephalitis should be started on acyclovir as soon as possible. If the diagnosis of herpes simplex encephalitis confirmed the therapy should be continued for at least 14 to 21 days, treatment with acyclovir reduces morbidity and mortality in patients with herpes simplex encephalitis[58]. For adults with normal renal function the dose of acyclovir is 10mg/kg intravenous every 8 hourly. A close watch on renal functions should be kept when elderly patients are receiving acyclovir. Acyclovir is also recommended for the treatment of varicella zoster encephalitis[59]. At present no anti viral drugs are approved for the treatment of Japanese encephalitis.Apart from anti-viralagents, patients of viral encephalitis are managed using supportive care like management of raised intracranial tension, management of seizures using anticonvulsants, prevention of bed sores and aspiration pneumonia.

Conclusion :

Elderly people are predisposed to develop various neurological infections. The diagnosis of neurological infections in the elderly may be challenging as typical clinical

features might be absent. There can be other non-infectious conditions like electrolyte imbalances, uremia, hepatic encephalopathy which can mimic a neurological infection. The presence of co-morbidities like diabetes and kidney diseases etc make the treatment of neurological infections in elderly even more challenging. The elderly is also at higher risk of developing adverse drug reactions. The prognosis of neurological infections in the elderly is poor as compared to the younger patients.

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