ABSTRACT

Background :Infectious disorders in general have high morbidity and mortality.. CNS infections include many disorders like bacterial meningitis, tuberculous and other subacute and chronic meningitis, viral meningitis, cerebral abscess, spinal cord infections, and others.

Objective: To assess our locality about prevalence of CNS infections , to have more awareness regarding CNS infections, and to try to find the proper way to reduce their prevalence and to treat them in appropriate way.

Method :We revised the records of all the cases of CNS infections excluding cases of spinal cord infections who were admitted in the wards of neuroscience hospital over the previous two years (from July/2010 to June 2012),those were 132 cases.Seasonal incidenceand other clinical aspects and other parameters like age , sex, , fever are extracted and recorded

Results: The most common CNS infections in sequence from the most to the least were bacterial meningitis, viral encephalitis, tuberculous meningitis, viral meningitis, and cerebral abscess.

The most common age group which is affected by CNS infections was below 10 years.

Males are affected more than females taking in consideration all types of infection.

P values were statistically significant for age, fever, signs of meningeal irritation, focal neurological deficit, and seizures.

Conclusion : The total rate of admission of CNS infections in our series was lower than other study.

The most frequent type of CNS infections was bacterial meningitis which is the same as most of the studies.

Males are affected more than females in our study in all types of CNS infections, this was approximate to other studies except for tuberculous meningitis.

Bacterial meningitis and viral encephalitis were more common in preschool children in our study.

Fever rate in bacterial and tuberculous meningitis was different from other studies.

Seizure rate in bacterial meningitis and viral encephalitis was approximate to other results.

Rate of focal deficit in viral encephalitis and tuberculous meningitis was different from other studies.

Rate of CSF protein elevation in all CNS infections was approximate to other studies.

Rate of hypoglycorrhachia was different from other studies only in tuberculous meningitis.

CSF pleocytosis was approximate to other studies in all types of CNS infections.

The two most common types of CNS infections , bacterial meningitis and viral encephalitis, are more common in preschool age groups.

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INTRODUCTION

Infectious diseases are endlessly fascinating and constantly changing because of new emerging infections and emerging strains of organisms that are resistant to antimicrobial agents. Those that affect the nervous system are no exception. [(1)]

Infections of the nervous system can be caused by viruses, bacteria, fungi or protozoa. These microorganisms can cause distinct clinical syndromes including bacterial meningitis, viral meningitis, encephalitis, focal infections such as brain abscess and subdural empyema, and infectious thrombophlebitis.

Understanding of neurological infection has been advanced by new techniques of molecular diagnosis, in particular wider availability of polymerase chain reaction (PCR) assay to detect bacterial and viral nucleic acid in cerebrospinal fluid (CSF), and improved imaging of brain and spinal cord. [(1)] Optimal therapy for CNS infections requires a broad knowledge of medicine, a close liaison with the microbiology laboratory and personnel, and careful clinical judgment. [(5)]

Bacterial meningitis is caused by a primary infection within the subarachnoid space that causes acute inflammation of the meninges (pia and arachnoid mater).The most common causative organisms of bacterial meningitis in children and adults are Streptococcus pneumonia and Neisseria meningitidis. Much of the pathophysiology of bacterial meningitis is a direct consequence of elevated levels of CSF cytokines and chemokines. [3]

Cerebral abscess is a focal suppurative (pus forming) infection occurring within the cerebral parenchyma.

Tuberculous meningitis is caused by Mycobacterium tuberculosis which is an aerobic non-spore forming bacillus which may be cultured and stained by Ziehl–Neelsen stain. Tuberculous meningitis develops secondary to a caseating tuberculous focus adjacent to the CSF (Rich Focus). These usually develop following prior haematogenous dissemination of mycobacteria and in the absence of pulmonary tuberculosis. [2]

Viral infections of the central nervous system (CNS) are complications of systemic viral infections and the virus gains access to the brain via the bloodstream or, less commonly, by travelling up peripheral nerves. Viral meningitis results from haematogenous infection and, to enter the CNS.. There is considerable overlap and some viruses cause meningoencephalitis, incorporating signs of both. [2],[8]

Difficulties:

1- Some of the important investigations are not available to us which are essential for certainty of diagnosis like PCR for tuberculosis or PCR for herper simplex virus etc. other investigations which are not available blood culture, CSF culture, CSF chloride concentration, CSF lactate dehydrogenase activity, and CSF lactic acid (gas chromatography or enzymatic analysis.
2- Some patients delay in presentation or are presented to us after taking multiple antimicrobial agents that will make diagnosis even more difficult.
3- Some of the important investigations are not available to us which are essential for certainty of diagnosis like PCR for tuberculosis or PCR for herper simplex virus etc. other investigations which are not available blood culture, CSF culture, CSF chloride concentration, CSF lactate dehydrogenase activity, and CSF lactic acid (gas chromatography or enzymatic analysis.
4- Some patients delay in presentation or are presented to us after taking multiple antimicrobial agents that will make diagnosis even more difficult.

Aim of the study

To perform a study about central nervous system infections in the neuroscience hospital and the extent they are stuck in and their effects in different aspects of patients' life.

Patients And Methods

A retrospective study conducted in the neuroscience hospital between June and September/2012 . We had reviewed all the database files of patients between the onset of 2010 and the end of 2011 searching for central nervous system infection patients (excluding the spinal cord). The total number of admitted cases was 3820 cases; 1890 patients in the first year (2010) and 1930 patients in the second year (2011). We record a 132 patients ; males were 78 and females were 54. Their ages range from newborn to 75 years old. Each patient file was examined and we register the following informations : name, age, gender, residence, job, season, and cerebrospinal fluid glucose, protein, and cells. According to season we classified the patients into winter (34), spring (32), summer(35), and autumn (20) groups.

Job , gender and age were taken from the files and we classify our patients into preschool age group i.e. below six years old were forty eight , school age group between 6 and 18 years old were eighteen

, between 19 and 45 years old were thirty three, between 46 and 60 years old were eighteen, and more than 60 years old were fifteen.

According to the file informations and diagnosis we classified our patients into those who have viral, bacterial, and tuberculous infections. This diagnosis was made according to the clinical features, cerebrospinal fluid analysis, and polymerase chain reaction for viral encephalitis and tuberculous meningitis.

Nearly all of the patients had been received some sort of antimicrobial agents before presentation.

We had studied many parameters in all CNS infections at first and then in each type of infections in all the age group and in both classifications. Fever was recorded in this study as core body temperature more than 37.7 C (9). According to the educational level we classified the patients into those who have education 9 years or less (62) and those who have more than 9 year(11).

Nine years level means that the patient had finished the primary school and first three years of the secondary school, and those who had finished more than 9 years . We had taken informations about cerebrospinal fluid from files regarding protein , cells, and glucose; comparing these parameters (protein more than 45mg/dl, leucocytes count more than 5/mm³, and glucose less than 40 mg/dl) with other studies. We also recorded the progress of patients' conditions; those who are improved (114), and those who died (18).

5- Some of the important investigations are not available to us which are essential for certainty of diagnosis like PCR for tuberculosis or PCR for herper simplex virus etc. other investigations which are not available blood culture, CSF culture, CSF chloride concentration, CSF lactate dehydrogenase activity, and CSF lactic acid (gas chromatography or enzymatic analysis.

6- Some patients delay in presentation or are presented to us after taking multiple antimicrobial agents that will make diagnosis even more difficult.

Statistics

Statistical analyses were computer assisted using statistical package for social sciences 20 (SPSS) and we calculate the significant difference between proportions using Pearson Chi-square test (p value) at 0.05 level.

RESULTS

132 patients who are admitted to the neuroscience hospital as CNS infections out of 3820 patients. These 132 patients were 76 cases of CNS infections out of 1890 cases in 2010 (4.02%) and 56 CNS cases out of 1930 cases in 2011 (2.90%), and we found the following observations: The admission rate for CNS infections in 2010 was 4.02% and in 2011 was 2.90%. The most common CNS infection was bacterial meningitis, accounting for 61 patients collectively which is equal to about 46.2% of the total number of CNS cases; 40.8% in 2010, and 53.6% in 2011, followed by viral encephalitis cases which are 44 patients collectively; 31.58% in 2010 and 37.03% in 2011, then tuberculous meningitis accounting for 20 patients totally; 15.8% in 2010 and 14.9% in 2011.

Bacterial meningitis, viral encephalitis and tuberculous meningitis are more common in males than females ; for bacterial meningitis 35 were males and 26 were females, for viral encephalitis 26 were males and 18 were females, and for tuberculous meningitis 12 were males and 8 were females. Bacterial meningitis is more common in preschool age group; those were 23 out of 61 , and this was also the case for viral encephalitis, i.e. 21 patients out of 44 , while this is not the case for TB meningitis which is more common in adults. The prevalence of CNS infections - in general - is more common during cold season (34.09%) than hot season (25%). CNS infections are more common in uneducated people (46.97% ;less than 9 years education) than in

educated ones (33% ; more than 9 years education).

Most of the patients are presented with typical syndromes , i.e. patients who have bacterial meningitis are presented with fever, headache, signs of meningeal irritation, photophobia , patients who have viral encephalitis are presented with disturbed consciousness, fever, seizure and focal sign. Although, this is not the case in children and in elderly in whom clinical presentation is vague and a little bit atypical. The mortality rate was 0.48% in 2010 and 0.47% in 2011 (total dead cases were 18) and the most common cause of death was delay in presentation , which is - sometimes – related in some way to low level of education.

Discussion

The total rate of admission of CNS infections per year was 3.46% which is different from the rate of admission in the study of Davies N [(10)] (7.4% per year) while for the first year it was 4.02% and for the second year it was 2.90%. The rate of admission is slightly lower in the second year than the first year of the present study.

The order of frequency of CNS infections in the present study are in order of frequency ; bacterial meningitis (46.2%), viral encephalitis (33.3%), tuberculous meningitis (15.2%), viral meningitis (3.8%), and cerebral abscess (1.5%).

There were a higher rate of admission for CNS bacterial infections (including bacterial meningitis, tuberculous meningitis and brain abscess) which was 62.88% per year than for viral infections (viral meningitis and encephalitis) which was 37.12% per year. These rates were different from a study of Polkowska A[(11)]. in Poland who found that 35% per year of his series were bacterial infections and 49.42% per year were viral infections . The higher rate of cases for viral over bacterial infections in the study of Polkowska A is most likely due to many cases of tick-borne encephalitis (Ixodes ricinus ticks) which were endemic in the north-eastern part of that country. The absence of Ixodes ricinus ticks , in addition to high incidence rate of tuberculous infections in our country making the bacterial infections of CNS more common than viral infections in the present study.

Males are affected more commonly than females in case of bacterial meningitis (57.37% were males and 42.63% were females), in viral encephalitis (59.1% were males and 40.9% were females), and in tuberculous meningitis (60% were males and 40% were females) in the present study. Regarding tuberculous meningitis this is different from Fan HW study who found more females rate (51% females and 49% males) [(12)].This difference may be due to the difference in the nature of the society; that is in our society males are more exposed to communication and so they are more liable to acquire infection, while in China both males and females are nearly equally affected. In case of viral encephalitis the results were approximate to Mailles A study [(13)].

The present study showed that both bacterial meningitis and viral encephalitis are more common in preschool age groups, mostly due to crowding and gathering in the schools. Other factors like low immunity and nutritional factors may be blamed. The present study showed that bacterial meningitis occurs most commonly in summer (32.78%) , and 38.63% of viral encephalitis occur in winter , and 40% of tuberculous meningitis occur in spring season. The higher occurrence of bacterial meningitis in summer was different from Bradley WG et al study who found that bacterial meningitis was more common in winter [(14),(15)]. The present study showed that viral infections are more common in winter which is different from the results of Hjalmarsson A study who found that viral infections are more common in summer. This can be explained by variability of causative agents[(16)]. The present study showed that tuberculous meningitis are more common in spring and this is similar to the results of Nagayama N study [(17)]. The present study showed that the presence

of fever (more than 37.7 C) occurred in 88.5% of patients with bacterial meningitis , 97.7% of patients with viral encephalitis, and 80% of patients with tuberculous meningitis. The present study showed that the fever rate in case of bacterial meningitis was slightly lower than the results of Naumova EN study (95%) [18] . In viral encephalitis the fever rate was approximate to Fan HW et al study (97%) [12],[19] , and the fever rate in tuberculous meningitis was slightly less than the results of the study of Leung CC et al(91%)[20],[21],[22],[23]. The seizures rate was 36.1% in bacterial meningitis , 72.7% in viral encephalitis and only 10% in tuberculous meningitis in the present study. This rate for bacterial meningitis was approximate to the results of Pizon AF et al study study (40%)[24] . In case of viral encephalitis the seizures rate was nearly the same as the results of Baringer JR study(75%)[25],[26] and in case of tuberculous meningitis seizures rate was less than the results of Bradley WG study (20%)[14]. Meningismus occured in 64% of bacterial meningitis, 29% of viral encephalitis, and 85% of tuberculous meningitis in the present study. The meningismus rate in bacterial meningitis in the present study was less than the results of the study of Mai NT (80%)[27]. In the present study meningismus in viral encephalitis was approximate to the results of DeBiasi, R. L. et al (20%)[28] . In tuberculous meningitis the results in the present study is close to the results of Allan H study (75%) and Garg RK study (79.2%)[29],[30] .

The present study showed that the rate of focal neurological deficits on presentation was 18% of bacterial meningitis , 47,7% of viral encephalitis, 40% of tuberculous meningitis. This rate was nearly the same as the results of Thigpen MC et al study[31]in case of bacterial meningitis. Focal deficits in cases of viral encephalitis in the present study was higher than the results of Johnson RP study (31.18%)[32] . In tuberculous meningitis cases in the present study FND rate was higher than the results of study of Davis J. E. et al (18%)[33]. This big difference can be explained by late presentation of many of our patients whether due to neglectfulness or due to low hygienic knowledge.

The present study showed that the rate of CSF protein elevation (above 45 mg/dl) was about 95% of bacterial meningitis cases (mean±SD =87.85±46.14) and this is the same as the results of Adams RD et al study[34],[35]. Regarding tuberculous meningitis CSF protein elevation rate in the present study was 95% (mean±SD=83.70±20.14), and for viral encephalitis 88.7% (mean±SD=79.00±76.60). These two rates are approximate to the results of Adams RD et al study who found that CSF protein was elevated in all cases of tuberculous meningitis and viral encephalitis.

The rate of hypoglycorrhachia in bacterial meningitis in the present study was 44% which is approximate to the results of Fan HW et al study (50%). The rate of hypo-glycorrhachia in tuberculous meningitis was 15% in the present study which is lower than the results of Fan HW et al study[12],[36]. Regarding viral encephalitis hypoglycorrhachia in the present study it was slightly different from the results of Merck study who found that CSF glucose was normal in all the cases of viral encephalitis [34].

CSF pleocytosis rate (more than 5 / mm^3) in bacterial meningitis in the present study was 97% which is approximate to the results of Fan HW study which was more than 87%[12],[36]. CSF pleocytosis in viral encephalitis in the present study was present in all cases which is similar to the results of Fitch MT and Merck studies which was more 95%[36],[37]. In tuberculous meningitis in the present study the result of CSF pleocytosis was the same as the study of Davis J.E. (all the cases) [33]. The mortality rate in bacterial meningitis was 14.75% in the present study which is close to the results of study of Weisfelt M (10-30%) [38]. The present study showed that viral encephalitis mortality rate is 13.6%

which is close to the results of Whitley RJ [39]. In tuberculous meningitis cases in the present study mortality rate was 5% which is lower than the results of Thwaits GE study (20%) [40] . The rate of dead cases in the present study was higher in bacterial meningitis than other types of infections . This higher mortality was because bacterial meningitis is the most common and most aggressive type of the CNS infections.

CONCLUSION

CNS infections in general are relatively common disorders in our society and have a great impact on life regarding seizures, focal neurological deficits, and raised intracranial pressure and carry significant morbidity and mortality.

The two most common types of CNS infections , bacterial meningitis and viral encephalitis, are more common in preschool age groups.

CNS infections as a whole are more common in males than females.

Age, fever, seizure, meningeal irritation and focal neurological deficits are statistically significant in the prevalence of CNS infections.

Recommendations

To make society more aware about the risk of CNS infections in order to take caution from such a risky diseases and to visit, as early as possible any health care centre when they complain from symptoms that may suggest a CNS infections and for all contacts to take a prophylactic antimicrobial agent like rifampicin.

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