ACUTE CENTRAL NERVOUS SYSTEM INFECTIONS

Essay

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NEUROPSYCHIATRY

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Dedication

Dedicated to my family and my wife for their

Love,

Support,

Patience

And

Understanding

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LIST OF ABBREVIATION

ADC : Apparent diffusion coefficient
AIDS : Acquired Immunodeficiency Syndrome
BBB : Blood Brain Barrier
C. : Cryptococcus
CBF : Cerebral blood flow
CDC : Centers for Disease Control and Prevention
CFAs : Complement-fixing antibodies
CMV : Cytomegalovirus
CNS : Central Nervous System
CRP : C-reactive protein
CSF : Cerebrospinal Fluid
CT : Computed Tomography
CTF : Colorado tick fever
DAMB : Deoxycholate amphotericin B
DS : Double sandwich
DWI : Diffusion-weighted imaging
EBNAs : Epstien-Barr nuclear antigens
EBV : Epstien-Barr Virus
EEE : Eastern Equine Encephalitis
EEG : Electroencephalogram
EIA : Enzyme immunoassay
ELISA : Enzyme linked immunosorbent assay
ESR : Erythrocyte sedimentation rate
EVs : Enteroviruses
FLAIR : Fluid-attenuated inversion recovery
G-ve : Gram negative
HAD : HIV-associated dementia

HAM : HIV- associated myelopathy
Hib : Haemophilus influenzae type b
HIV : Human Immunodeficiency virus
HSE : Herpes Simplex Encephalitis
HSV : Herpes Simplex Virus
ICP : Intracranial pressure
ICP : Intracranial pressure
IFN : Interferon
IM : Intramuscular
IV : Intravenous
IVIG : Intravenous immunoglobulin
JE : Japanese encephalitis
LACV : La Cross virus
LFAB : Lipid formulation of Amphotericin B
Mh : Mycoplasma hominis
MMR : Measles Mumps and Rubella
Mon : Month
Mp : Mycoplasma pneumoniae
MRA : Magnetic resonance angiography
MRI : Magnetic Resonance Imaging
MRV : Magnetic resonance venography
MVE : Murray Valley encephalitis
N. : Neisseria
NSAIDs : Non steroidal anti inflammatory drugs
OLM : Ocular larva migrans
PA : Pyogenic abscess
PCR : Polymerase chain reaction
PMN : Polymorphonuclear
PMRS : Proton magnetic resonance spectroscopy
RIG : Rabies immunoglobulin

SE : Subdural empyema
SIADH : Syndrome of inappropriate antidiuretic hormone secretion
SLE : St. Louis encephalitis
SPECT : Single photon emission computed tomography
TBE : Tick borne encephalitis
TE : Toxoplasmic encephalitis
TMP-SMX : Trimethoprim-sulfamethoxazole
TOSV : Toscana virus
U.S. : United States
Uu : Ureaplasma
VCA : Viral capsid antigen
VEE : Venezuelan equine encephalitis
VLM : Visceral larva migrans
VZV : Varicella Zoster Virus
WBC : White blood cells
WK : Week
WNV : West Nile Virus

INTRODUCTION

Infections of the central nervous system (CNS) are notable for their diversity. They range from common to rare, acute to chronic, and benign to fatal. Although some are self limited or are easily cured with modern treatment, others are progressive despite treatment or have no known treatment. For the many CNS infections that are treatable, prompt diagnosis and aggressive management afford the best chance of recovery without sequelae ***(Marra, Whitley and Scheld ٢٠٠٤).***

Causative pathogens of acute CNS infections:

The causative pathogens include certain bacteria, viruses, protozoas, helminthes and fungi.

The manifestations of viral nervous system involvement are myriad, including meningitis (Acute or chronic), encephalitis (Acute or chronic), myelitis, ganglionitis and polyradiculitis ***(De Biasi et al., ٢٠٠٤).*** Causative viruses include: Enteroviruses, Herpes simplex virus, Epstein-Barr virus, Mumps virus, Cytomegalovirus, Rabies

virus, Varicella-Zoster virus, Human immunodeficiency virus and Arboviruses.

Bacterial pathogens invading intracranial structures can cause *pyogenic meningitis*, *brain abscess*, *epidural abscess*, *subdural empyema or suppurative intracranial phlebitis* ***(Verma and Solbrig ٢٠٠٤).*** Brain abscess, subdural empyema, and extradural abscess are all forms of intracranial suppurations. They share common clinical features-they occur relatively infrequently and they present as emergencies ***(Anderson ٢٠٠١).***

The incidence of central nervous system fungal infections varies greatly with the geographic location; with respect to clinically recognized fungal central nervous system illnesses, Cryptococcus and Candida infections are the most common ***(Behari et al., ٢٠٠٤).***

Protozoan infections (Naegleria fowleri, Entamoeba Histolytica and Toxoplasma) can cause acute meningitis and meningoencephalitis while Helminthes (Angiostrongylosis, Gnathostomiasis, Strongyloidiasis, Paragonimiasis and Toxocariasis) can cause nervous system involvement due to their size, mobility and challenge to the host immune

response causing meningoencephalitis ***(Behari et al., ٢٠٠٤).***

Clues on physical examination in CNS infections:

Physical examination in the setting of suspected CNS infection has three purposes: a) to identify contraindications to lumber puncture, (b) to identify concomitant sites of infection or pathology that provide clues to the infectious etiology, and (c) to define the site of CNS infection. Depressed level of consciousness, focal neurologic abnormalities, or seizures may indicate a structural CNS abnormality that poses a risk of brain or spinal cord herniation after lumber puncture. Such findings mandate neuroimaging before lumber puncture. Identification of concomitante pneumonia, diarrhea, and skin or bone lesions may offer clues to the etiology of infection. Most importantly, findings on neurologic examination allow for identification of the most likely site or sites of infection among CSF space, brain, or spinal cord ***(Marra, Whitley and Scheld ٢٠٠٤).***

Diagnostic evaluation:

The prognosis of CNS infections mainly depends on rapid identification of the site of

inflammation and pathogen to install effective antimicrobial treatment as early as possible. Analysis of CSF, neuroimaging and EEG analysis remain the gold standard to identify the infectious agent and is clearly depicting inflammatory lesions of brain and spine ***(Kastrup et al., ٢٠٠٥).***

The Cerebrospinal Fluid (CSF) is abnormal in more than ٩٠% of cases; however, routine CSF studies only rarely lead to identification of a specific etiologic agent. Diagnosis of viral infections of the CNS has been revolutionized by the advent of new molecular diagnostic technologies to amplify viral nucleic acid from CSF, including Polymerase Chain Reaction (PCR), nucleic acid sequence-based amplification, and branched-DNA assay. One of the most successful applications of CSF PCR is the diagnosis of viral nervous system infections. PCR is ideally suited for identifying fastidious organisms that may be difficult or impossible to culture ***(De Biasi and Tyler ٢٠٠٤).***

Neuroimaging plays a crucial role in the diagnosis and therapeutic decision making in infectious diseases of the nervous system. In cases of uncomplicated meningitis, cranial Computed

Tomography (CT) appears to be sufficient for clinical management to exclude acute brain edema, hydrocephalus, and pathology of the base of skull. Magnetic Resonance Imaging (MRI) is superior in depicting complications like sub-/epidural empyema and vasculitic complications notably on fluid-attenuated inversion recovery (FLAIR)-weighted images. The newer technique of Diffusion-Weighted Imaging (DWI) shows early parenchymal complications of meningitis earlier and with more clarity and is of help in differentiation of Pyogenic Abscess (PA) from ring enhancing lesions of other etiology. Proton Magnetic Resonance Spectroscopy (PMRS) seems to produce specific peak patterns in cases of abscess. The presence of lactate cytosolic amino acids and absence of choline seems to indicate PA ***(Kastrup et al., ٢٠٠٥).***

Nonetheless, at an early stage, the results of imaging studies may be equivocal, and the electroencephalogram (EEG) is a valuable investigation tool whenever CNS infection is suspected ***(Bolton ١٩٩٨)***.

Optimal therapy for CNS infections requires a broad knowledge of medicine, a close liaison with

the microbiology laboratory and personnel, and careful clinical judgment. Many CNS infections, including bacterial meningitis and viral encephalitis, are life threatening conditions and must be treated emergently, often before the causative organism is definitively identified. Initial antimicrobial agent must be chosen empirically and must be active against the range of potential infectious agents consistent with the clinical scenario ***(Verma ٢٠٠٤).***

Neurologists are often equally bewildered by the dazzling and ever expanding array of new antimicrobial agents. These problems are made more intense by the fact that the overwhelming majority of CNS infections are in fact treatable or preventable diseases, and that their ultimate outcome may depend on the accuracy and speed with which the diagnostic and therapeutic decisions are made ***(Tyler and Martin ١٩٩٧).***

Acute CNS infections are better to be classified according to the causative pathogens as the recent investigational tools nowadays are directed towards specific pathogens; for example,