



MICROBIOLOGY

DONE BY :

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Other CNS infections

- Brain abscess
- Parameningeal infections
- Toxoplasmosis
- African trypanosomiasis
- Cerebral malaria
- Miscellaneous viruses that affect the CNS

Brain Abscess

abscess is a collection of pus.

pus consist of dead tissue, cells, and bacteria.

- Brain abscess is considered as one of the most serious diseases of the Central Nervous System (CNS). This is more common among men and the morbidity rate is highest in the fourth decade of life

- It is associated with high morbidity and includes seizures, persistent alteration in the mental status and also focal motor deficits. *not diffuse*
focal : the deficit is in eye or arm.

- Brain abscess acquired by

طريقة الانتقال للميكروبات الي بتعمل abscess
اما عن طريق الدم او مكان الانفكشن تاعهم يكون قريب من الدماغ زي الانف او الحلق او الفم

- Spread from a nearby focus of infection
 - Sinusitis, otitis media or mastoiditis
 - Dental sepsis
 - Penetrating injury or neurosurgery
- Hematogenous spread from a distant site of infection
 - Congenital heart disease with a right to left shunt

- Hereditary hemorrhagic telangiectasia with AV fistulas
- Suppurative pulmonary infection
- Endocarditis
- Opportunistic infections arising in patients who are immunocompromised

Etiology

- Streptococci, both aerobic and anaerobic
- Other aerobic bacteria such as Staphylococci or Gram negative rods
- Anaerobic bacteria are often present
- Unusual microorganisms such as fungi and Toxoplasma gondii cause brain abscess mainly in the severely immunocompromised

غالباً الي بعمل abscess بكونش ميكروب واحد وانما مجموعه

Presentation

مهم بالهستوري
انه المريض بكون مصاب من قبل قتره بانفكشن بالانف او الحلق او التجايف ولكن مش دايماً بصاحب abscess اشي زي هيڪ

- The presenting symptoms often evolve slowly and are non-specific Symptoms and signs of the predisposing disease such as sinusitis, otitis media, dental sepsis, or pulmonary disease are often but not always present
- Symptoms
- Headache is the most common symptom (70% of patients) and can be localized or generalized
- Fever is present in slightly less than one half of adults
- Seizures, nuchal rigidity, and papilledema

- Altered mental status and hemiparesis are the most common focal neurologic signs

- ❖ Neurologic signs frequently predict the site of disease

- Bizarre behavior with frontal lobe abscess
- Speech abnormalities with temporal lobe abscess
- Ataxia, nausea, and nystagmus with cerebellar abscess
- Visual field cuts with temporal, parietal, or occipital lobe abscess

حسب الاعراض ممكن تتوقع المكان المصاب بالدماع

زي مثلا الاعراض الي بتصيب النظر يكون غالبا بل lobes الي بتشمل مركز الرؤية بالدماع وهمه ثلاث

temporal,parietal,or occipital

- Despite of this, mortality has decreased from 50-20% as a result of introduction of CT scanning. CT scanning resulted in earlier diagnosis and accurate localization of the abscess.

كثير قلت الوفيات لانه صار سهل نشوفها عن طريق التصوير CT

Diagnosis and management

- Neurodiagnostic imaging, high resolution CT scan with enhancement or MRI scan with

enhancement, are now the diagnostic procedure of choice for brain abscess

- Management of these infections requires a multidisciplinary approach, consisting of a combination of neurosurgical intervention and appropriate long term antibiotic therapy

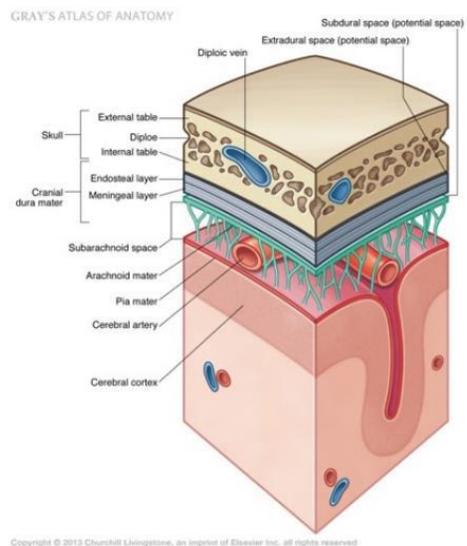
مهم كثير تتدخل جراحيا لانه ممكن الabscess بتضغط ع مكان معين بالدماع ويعمل injury ويعمل اعراض و مضاعفات

بعديها بنعطي مضادات حيويه

Parameningeal infections

- Subdural empyema
- Intracranial epidural abscess
- Spinal epidural abscess
- Septic thrombosis of the dural sinuses

هدول انفكشن بالطبقة الخارجيه للسحايا
وهمه epidural and subdural



Subdural Empyema

- Subdural empyema is a localized collection of pus contained between the dura and arachnoid
- Arises most often 60 to 70 as an extension from sinusitis, especially frontal sinusitis Otitis media with or without mastoiditis is the other major cause Cases also result from trauma or surgery
- Streptococci and especially anaerobic streptococci are again the most common isolates, but staphylococci (notably, *S. aureus*) and aerobic gram negative rods are also encountered
- Subdural empyema usually evolves more rapidly than does brain abscess

لانه هون المساحة ضيقه فأى تجمع بيعمل اعراض وبأثر

- Typically, symptoms suggestive of sinusitis or of otitis media are followed within days to several weeks by fever, severe headache, neck pain and then by altered mental status and focal neurologic signs, sometimes with seizures

هون لانه يعتبر هاد النوع زي التهاب السحايا
لهيك الاعراض الثلاثة بتظهر هون لكن مثلا بل epidural infection ما يكون فيه لانه يكون برا السحايا

- The mortality for subdural empyema from 6 to 20 Many patients, and especially those with subdural empyema, are often left with a neurologic deficit

Intracranial epidural abscess

- Intracranial epidural abscess is a collection of pus between the dura mater and the skull
- Intracranial epidural abscess, which is rare, has similar predisposing causes and a similar microbiology to subdural empyema
- Intracranial epidural abscess usually develops slowly over weeks or even months

هاد الفرق الاول عن subdural

- Nonspecific symptoms give way to symptoms of increased intracranial pressure (nausea, vomiting, headache, altered mental status) and focal neurologic signs.

وهي لانه الانفكشن بكون زي الاشئ الخارجي عن الدماغ وبأثر عليه لهيك بتكون الاعراض صداع واضطراب الحاله العقليه

Spinal epidural abscess

- Spinal epidural abscess classically presents initially with fever and back pain and progresses to weakness of the lower extremities with impaired bowel or bladder function and then to paralysis. The correct diagnosis is seldom made at the first patient encounter

هون الطبقة epidural of spinal cord

لهيك بكون الضغط عالجيل الشوكي
واحنا بنعرف انه الحبل الشوكي بطلع منه الاعصاب للاطراف والاعضاء زي المثانه او الامعاء لهيك ممكن يتأثرو.
الدكتور حكت انه مثلا زي الديسك (بضغط عالاعصاب)

- Spinal epidural abscess is acquired through

- a complication of vertebral osteomyelitis or diskitis
- Hematogenous dissemination
- a complication of spinal surgery, trauma, drug use, or spinal anesthesia

- S aureus is the most common microorganism, being found in more than 60 of cases, but aerobic gram-negative rods, streptococci and M tuberculosis are also major causes of the disease

- Untreated, spinal epidural abscess progresses to complete compression of the spinal cord with permanent paralysis

إذا فيه حالة التأخير في تلقي العلاج ممكن الضغط يتضاعف ونخسر الوظيفة تاعت الاعصاب للأبد

Cavernous sinus thrombosis

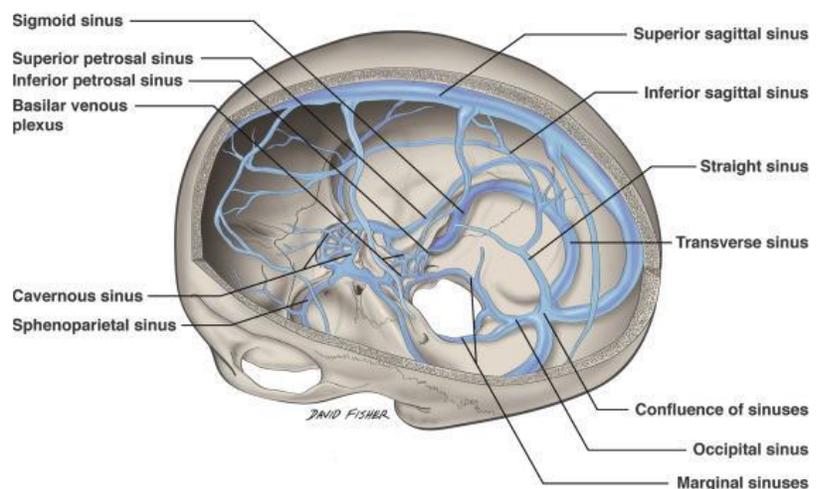
- Septic thrombosis of the large dural sinuses that provide venous drainage to the brain is a rare but life-threatening cause of severe headache Diagnosis is usually delayed

اهم عرض هو صداع شديد
لهيك غالبا التشخيص يكون صداع نصفي migraine وهاد خطأ

- There are 3 major syndromes

هاد التخثر بصيب اجزاء
واكثر ثلاث بتعرضو همه هدول
venous drainage of brain

1. Cavernous sinus thrombosis
2. Lateral (transverse) sinus thrombosis
3. Superior sagittal sinus thrombosis



Causes

1. Facial infections, most often nasal furuncles, precede about 50 of cases
 2. Sphenoid sinusitis accounts for about 30 of cases
 3. Dental infections about 10 of cases
 4. Otitis media, mastoiditis, or other nearby localized infections
- ❖ Staphylococcus aureus is the most common etiologic agent S pneumoniae and other streptococci explain some cases, and anaerobic bacteria sometimes cause the condition especially when it is due to dental infection or other forms of sinusitis
 - ❖ Diabetes mellitus is possibly a risk factor
 - Most patients with cavernous sinus thrombosis present with severe, progressive, unilateral, retroorbital and frontal headache Migraine is a common misdiagnosis
 - Subsequent symptoms include unilateral swelling of the orbit, diplopia, and drowsiness Rapid progression of the disease leads to proptosis, chemosis, papilledema, and ophthalmoplegia (inability to move the eyeball)

لانه ال cavernous sinus
يكون خلف العين
لهيك اهم الاعراض والمضاعفات بتكون بالعين

- Untreated, septic cavernous sinus thrombosis is nearly uniformly fatal

Diagnosis and management

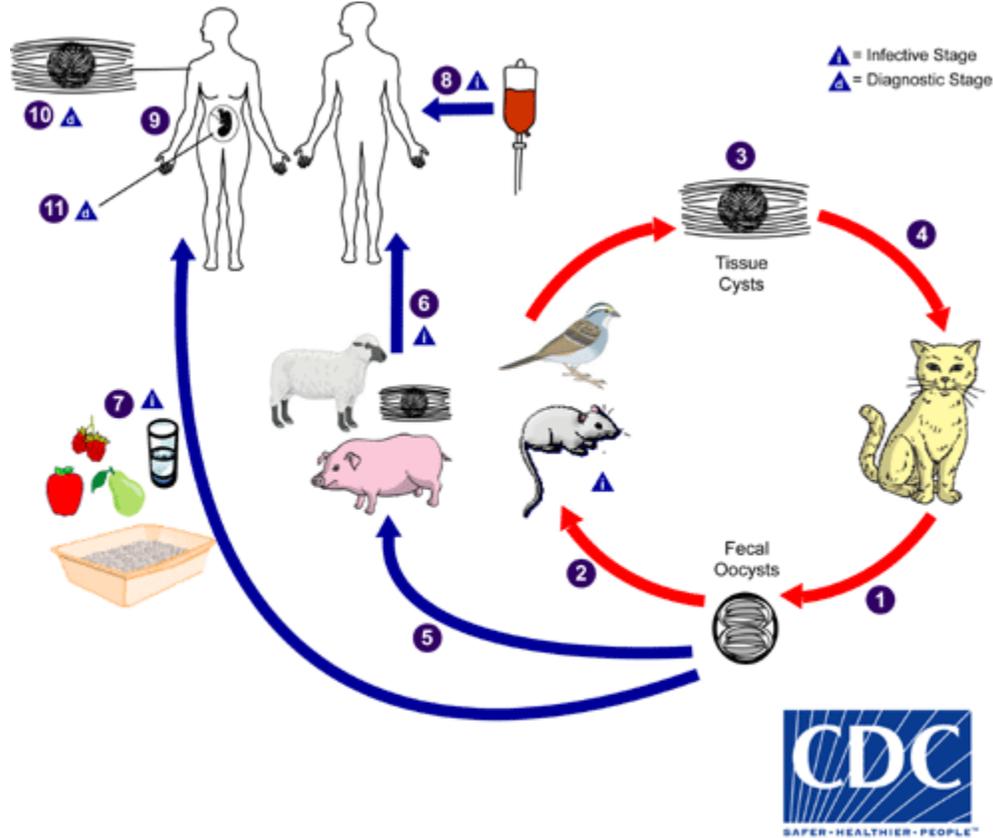
- The diagnostic evaluation of parameningeal infections requires advanced imaging technology

Magnetic resonance imaging (MRI) is preferred in most instances

- Management of these infections requires a multidisciplinary approach, consisting of a combination of neurosurgical intervention and appropriate long term antibiotic therapy

Toxoplasmosis

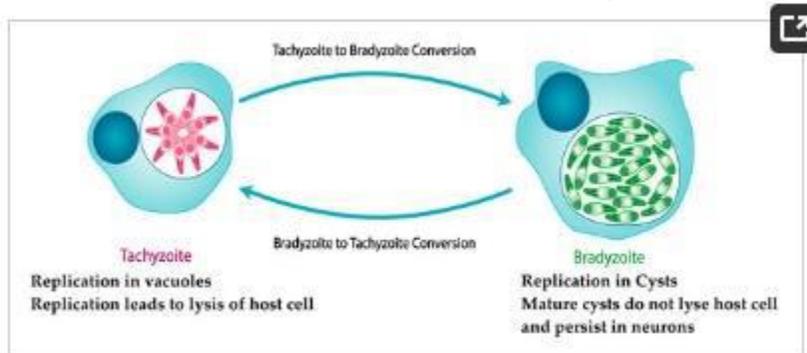
- Toxoplasmosis is caused by infection with the protozoan *Toxoplasma gondii*, an obligate intracellular parasite
- In most immunocompetent individuals, primary or chronic (latent) *T. gondii* infection is asymptomatic
- Neurological symptoms associated with toxoplasmosis
- Infection in immunosuppressed individuals
- Congenital toxoplasmosis المرأة الحامل اذا انصابت بتنقله لليبيبي



البسة بتاكل الطير او الفار
غالباً انسجتهم بتكون ملوثة بل cyst تاغون *T. gondii*
وهيك البسة بتصير حامله للمرض
بخرجو ال cyst عن طريق فضلات البسة
ف أي شرب او اكل غذاء ملوث بفضلات البسة او مثلاً لما حدا ينظف بسة البيت وما يغسل ايده ويوكل
فبتدخل وينصاب الشخص

Pathogenesis

فيه عنا مرحلتين
الاولى tachyzoites
والثانيه bradyzoite
الفرق بيناتهم انه
ال tachyzoites يكونو سريع بالتكاثر وبتكاثره جوا vacuoles وهاي ممكن تدمر الخليه العصبية
اما bradyzoite بتكون بطيئة وبتكاثر جوا cyst
ولما تكبر ما بتعمل تدمير
لكن بحالة نقص المناعه بتتحول bradyzoite to tachyzoite



- In individuals chronically infected with T gondii the parasite resides in tissue cysts in neurons in the brain
- T gondii consists of two stages in the brain, the rapidly replicating tachyzoite stage and the slowly replicating bradyzoite stage in cysts
- Tachyzoites enter the brain shortly after infection and initially replicate in neurons as well as astrocytes and microglia, but convert to the bradyzoite stage, producing cysts located in neurons
- Intraneural cysts last for the lifetime of the chronically infected host The chronic infection in immunocompetent individuals has been considered to be asymptomatic However, under certain circumstances the cyst may rupture and bradyzoite to tachyzoite conversion occurs
- Immunocompromise is one of the major reasons for intraneural cyst rupture Among immunodeficient individuals, toxoplasmosis most often occurs in those with defects of T cell mediated immunity.

three diseases that toxoplasmosis often occur with .

1- Patients with hematologic malignancies

2- Bone marrow and solid organ transplants

3- Acquired immunodeficiency syndrome (AIDS)

- AIDS as the host adaptive immune response weakens, parasite tissue cysts rupture and release bradyzoites. Then they convert to the rapidly dividing tachyzoite stage and produce significant morbidity, including Toxoplasma encephalitis

- Toxoplasmosis is considered as an **AIDS defining illness** (CD 4 count < 200)

Presentation

- Toxoplasma encephalitis and brain abscess present most commonly as headache, but focal neurologic deficits and seizures are as common. With significant disease, patients may also demonstrate the signs and symptoms of elevated intracranial pressure

- Recent investigations have suggested that chronic toxoplasmosis may play several roles in the etiology of different mental disorders such as schizophrenia and psychosis

Congenital Toxoplasmosis

- When a mother is infected with *T gondii* during gestation, the parasite may be transmitted to the fetus transplacentally or during vaginal delivery

- If the mother acquires the infection in the first trimester and it goes untreated, the risk of infection to the fetus is approximately 14-17% and toxoplasmosis in the infant is usually severe

- Manifestation of toxoplasmosis in the fetus

- Encephalomyelitis (inflammation of the brain and spinal cord)

- Retinochoroiditis (15% of patients)

- Intracranial calcifications (in about 10%)

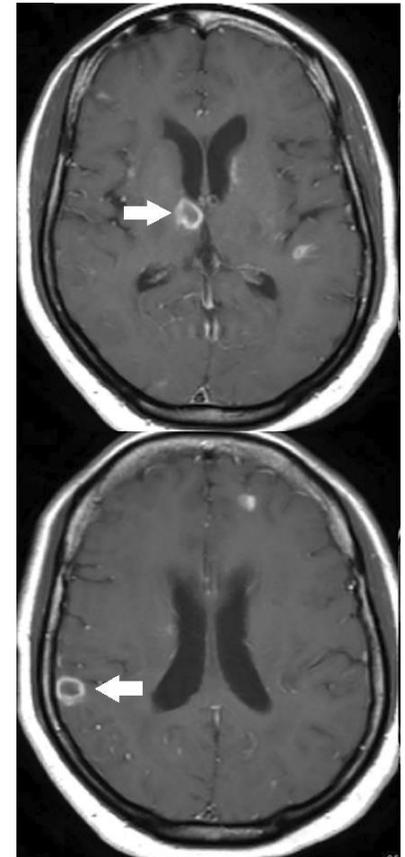
- Microcephaly

◦ Affected survivors may have mental retardation, seizures, visual defects, spasticity, hearing loss or other severe neurologic sequelae. The prevalence of sensorineural hearing loss is as high as 28 in children who do not receive treatment

Diagnosis

- Cerebral toxoplasmosis is generally identified on computed tomography (CT) scan as multiple ring-enhancing lesions however, solitary lesions may be seen
- The incidence of toxoplasmosis (including CNS disease) in patients with AIDS has declined dramatically, likely due to the evolution of highly active antiretroviral therapy (HAART) and the routine use of prophylaxis against *P.jiroveci* and *T.gondii*.

صرنا نعطيه دويين كوقايه لما يصير ال CD4 count عند مريض الايدز اقل من 400
لهيك هاد خفف حدوث الانفكشن عندهم



Management and prevention

- Toxoplasmosis is treated with **Sulfadiazine and pyrimethamine** combination
- Prophylaxis for prevention of toxoplasmosis in HIV patients is **trimethoprim and sulfamethoxazole** given daily until patient's immune system is reestablished (CD4 count is more than 200)

African trypanosomiasis

- African trypanosomiasis (sleeping sickness) is an illness endemic to sub-Saharan Africa
- It is caused by the flagellate protozoan *Trypanosoma brucei* which is transmitted to human hosts by bites of infected tsetse flies
- There are 2 stages of the disease
- Stage 1 (early/hemolymphatic) stage

- Stage 2 (late/neurologic) stage هاي هنكي عنها

Presentation

- Symptoms of stage 2 of African trypanosomiasis include the following

- Persistent headaches (refractory to analgesics)
- Daytime somnolence followed by nighttime insomnia
- Behavioral changes, mood swings, and, in some patients, depression
- Weight loss
- Seizures in children (rarely in adults)

Treatment

- Complications if untreated include meningoencephalitis and seizures, coma (sleeping sickness) and eventually death
- The type of drug treatment used depends on the stage of African trypanosomiasis (sleeping sickness) that is, whether it is stage 1 (early/hemolympathic) or stage 2 (late/neurogenic)
- Management of stage 2: Melarsoprol

Prevention (CDC)

- Wear long sleeved shirts and pants of medium weight material in neutral colors that blend with the background environment Tsetse flies are attracted to bright or dark colors, and they can bite through lightweight clothing اهم شي تجنب القرص من هاي الحشره
- Inspect vehicles before entering
- Avoid bushes
- Use insect repellent

Cerebral Malaria

احد انواع الملاريا ممكن توصل CNS وتعمل اعراض

- Cerebral malaria is the most severe neurological complication of infection with **Plasmodium falciparum** malaria It is a clinical syndrome characterized by coma and asexual forms of the parasite on peripheral blood smears
- Mortality is high and some surviving patients sustain brain injury which manifest as long term neuro cognitive impairments
- The clinical hallmark of cerebral malaria is impaired consciousness, with coma as the most severe manifestation

Presentation

هنقسمها لقسمين
الاول اطفال من افريقيا
الثاني بالغين من جنوب شرق اسيا
مهم تفرقو بينهم بالأعراض الي بتصيبهم

- Most transmission occurs in Africa where children under the age of 5 years are most affected In South-East Asia, malaria occurs more commonly in adults
- In African children, coma develops suddenly with seizure onset often, following 1-3 days of fever. A few children develop coma following progressive weakness Brain swelling, intracranial hypertension, retinal changes and brainstem signs (abnormalities in posture, ocular movements or abnormal respiratory patterns) among other-non neurological symptoms are commonly observed. The prognosis is grave in deeply comatose patients with severe metabolic acidosis, shock, hypoglycemia and repeated seizures
- In adults, cerebral malaria is part of a multi organ disease Patients develop fever, headache, body ache and progressively, delirium and coma Compared to African children, seizures, papilledema and retinal changes are less common.

Treatment and complications

- Without treatment, cerebral malaria is invariably fatal

- In children, parenteral antimalarials are indicated, but even with this treatment, 15-20% die
- In adults, mortality was lower if patients were treated with intravenous antimalarials
- Surviving patients fully recover but over the past 20 years, it became clear that many children sustain significant brain injury Although some gross deficits, particularly blindness, ataxia and central hypotonia improve with time, 25% have long term impairments especially cognition, motor function or behavior impairments and epilepsy develops in 10%.

Miscellaneous viruses

- Epstein Barr virus (EBV): Primary CNS Lymphoma, myelitis
- HHV-6, HHV-7: Encephalitis
- HTLV: Myelitis
- Nipah and Hendra virus: Meningitis and/or encephalitis

Good Luck