Pediatric intracranial abscess

- Spectrum of Central Nervous System Disease Caused by Streptococcus anginosus Group: A Single-Center Case Series
- A Case of Acute Coalescent Mastoiditis With Early Diagnosis of Lupus Anticoagulant-Hypoprothrombinemia Syndrome Prompting Immediate Surgical Drainage
- Abdominal tuberculosis in children: a systematic review on current advances
- Otogenic Lateral and Transverse Sinovenous Thrombosis in a Child: A Case Report
- Preventing What Matters: A Fast and Reliable Technique to Secure External Ventricular Drains and Avoid Dislodgement
- Community-acquired cerebral abscess and intracranial empyemas in children: a prospective cohort study
- Changes in Clinical and Microbiological Characteristics of Acute Mastoiditis in Children: A Comparative Study Between 2001-2008 and 2021-2024
- Impact of COVID-19 on the epidemiology of severe sinogenic and otogenic infections and their intracranial complications

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Intracranial infections in children are a relatively rare, but potentially severe condition.

see Pediatric brain abscess

Etiology & Risk Factors

Common Pathogens: Bacterial: Streptococcus spp. (S. milleri group), Staphylococcus aureus, Haemophilus influenzae, Enterobacteriaceae, and anaerobes.

Fungal: Aspergillus, Candida (especially in immunocompromised children).

Parasitic: Toxoplasma gondii (in congenital infections or immunosuppression).

Predisposing Factors:

Sinusitis, otitis media, mastoiditis

Congenital heart disease with right-to-left shunt (e.g., tetralogy of Fallot)

Immunodeficiency (e.g., HIV, malignancies)

Penetrating head trauma or neurosurgical procedures

Because of the potential for rapid deterioration, timely diagnosis and treatment are necessary. These infections are categorized based on their intracranial location: intracranial epidural abscess, intracranial subdural empyema, and brain abscess. They largely arise from direct extension of adjacent infection, hematogenous seeding, or trauma.

Clinical presentations of intracranial infections also vary. However, common signs and symptoms include headache, fever, nausea and vomiting, altered mental status, focal neurologic deficits, and seizures.

Diagnosis

see also Intracranial abscess diagnosis.

In general, MRI demonstrates a peripherally enhancing lesion with a high signal on diffusion-weighted imaging (DWI). Bacterial isolates vary, but most commonly are a single pathogen.

Treatment

Successful treatment requires a multidisciplinary team approach including such modalities as antibiotic therapy and surgical drainage. When possible, open surgical evacuation of the abscess is preferred, however, in cases of deep-seated lesions, or unstable patients, aspiration has also been performed with good results [1)].

Empirical Antibiotic Therapy (IV for 4-8 weeks, followed by oral antibiotics)

For community-acquired infections: Ceftriaxone or Cefotaxime + Metronidazole ± Vancomycin (if MRSA suspected) For post-surgical or trauma-related abscesses: Vancomycin + Cefepime or Meropenem + Metronidazole For immunocompromised patients: Consider antifungal or antiparasitic agents as needed. Surgical Intervention

Aspiration vs. Craniotomy: Depending on size (>2.5 cm), location, and response to medical therapy. Ventriculostomy (if hydrocephalus is present) Supportive Care

Seizure prophylaxis (if cortical involvement or history of seizures) ICP management (elevate head of bed, osmotic therapy with mannitol or hypertonic saline)

Systematic reviews and meta-analysis

A review aims to elucidate the role of endoscopic sinus surgery (ESS) on the outcomes of pediatric patients with sinogenic intracranial infections.

Methods: MEDLINE, Embase, and the Cochrane Library were searched for articles that described the outcomes in pediatric patients who had intracranial complications of acute rhinosinusitis (ARS) and underwent ESS with or without open neurosurgical approaches (ONA) or external sinus approaches (ESA). Primary outcomes of interest include mortality, revision surgery, length of stay, and neurological sequelae. Random effects meta-analysis was performed.

Results: Forty-eight articles met the final eligibility criteria, totaling 710 pediatric patients and 905 intracranial complications. The most common complications were subdural empyema (n = 261, 29

%), epidural abscess (n = 213, 24 %), and Pott's Puffy tumor (PPT) (n = 95, 10 %). When comparing patients who underwent ESS (alone or combined with ONA) to those who underwent ONA only, there was a decreased risk of revision surgery (RR = 0.66, 95 % CI = 0.38-1.12 and RR = 0.63, 95 % CI = 0.36-1.09, respectively) and decreased risk of neurological sequelae (RR = 0.65, 95 % CI = 0.15-2.74 and RR = 0.50, 95 % CI = 0.20-1.26, respectively), however these differences were not statistically significant. When patients who underwent combined intervention were compared to ESS only, the risk of revision surgery (RR = 1.04, 95 % CI = 0.62-1.72) and neurological sequelae (RR = 0.99, 95 % CI = 0.37-2.64) were similar. The risk of mortality was minimal and similar across all interventions.

Conclusion: The current study including primarily small retrospective studies found no statistically significant differences between children who received ESS alone, ESS with ONA or ONA alone, on mortality, revision surgery, length of stay, and neurological sequelae. Although ESS may be beneficial for managing certain pediatric sinogenic intracranial infections, its true effectiveness is difficult to determine due to the variability in the types of intracranial complications and the inconsistent extent of ESS procedures reported in the literature [2].

Retrospective observational studies

Children admitted to the pediatric infection service with a diagnosis of IA between 2011 and 2022 were included in the study. Abscesses were divided into two groups: infratentorial and supratentorial. Demographic characteristics of the patients, complaints, MRI findings, and follow-up data were recorded and compared between the two groups.

The study included 23 patients, 9 (39.1%) of whom were male, with a mean age at diagnosis of 79.3 ± 65.4 months. The most common complaints were headache (39.1%), fever (91.3%), focal neurological deficits (60.9%), seizures, loss of consciousness (26.1%), and meningitis findings (60.9%). The most frequent etiology was post-operative procedures (30.4%), followed by a history of meningomyelocele (13%), and congenital heart disease (8.7%). On MRI, 68.7% of the supratentorial abscesses were multiple and commonly localized in the frontal and parietal regions. Treatment included ceftriaxone (82.6%), vancomycin (65.2%), meropenem (43.5%), metronidazole (34.8%), and linezolid (17.4%). The median hospitalization duration for patients was 32 days (range: 14-150). Of the patients, 34.8% were hospitalized and followed in the intensive care unit, and neurosurgery performed surgical interventions in 60.9% of cases, with evacuation in 21.7% of cases. In cultures, the causative agent was identified on average within 4 ± 1.3 days. Recurrence of abscess occurred in three (13%) cases, and 13% of cases had residual sequelae.

Intracranial abscess is a rare infectious disease that can result in long-term neurological deficits requiring extended follow-up and treatment. A correct and effective approach also positively impacts the prognosis of patients [3].

This study provides a valuable retrospective analysis of pediatric intracranial abscesses, highlighting demographic characteristics, clinical presentation, imaging findings, treatment approaches, and outcomes. The findings reinforce the importance of early diagnosis, appropriate antimicrobial therapy, and timely neurosurgical intervention in managing this rare but serious condition.

However, several limitations must be acknowledged, including the small sample size, single-center design, lack of statistical comparisons, and limited long-term neurological outcome assessment. While the study offers useful insights, its conclusions would be strengthened by larger, multi-center studies

incorporating control groups, advanced microbiological diagnostics, and standardized follow-up assessments.

Future research should aim to further clarify optimal treatment strategies, improve pathogen identification, and assess long-term neurodevelopmental outcomes, ultimately improving the clinical management and prognosis of pediatric intracranial abscesses.

Case reports

A 12-year-old male patient was diagnosed with preseptal cellulitis that progressed to a subperiosteal orbital abscess and eventually intracranial extension, despite outpatient antibiotic therapy. Initially treated with oral antibiotics for left eyelid swelling and pain, his condition worsened, prompting hospital admission and eventual surgical intervention. Imaging revealed multiple abscesses and a hematoma, causing a mass effect on the globe and extraocular muscles. Despite aggressive medical management, surgical drainage was required, including a craniotomy for drainage of an epidural abscess. This case highlights the importance of timely escalation of care when complications arise from preseptal cellulitis [4].

A 13-year-old male developed epidural empyema and orbital cellulitis as a complication of acute sinusitis. The patient initially exhibited signs and symptoms of orbital cellulitis, including eyelid swelling, erythema, and pain. Subsequently, the patient's condition worsened, with the development of fever and an intensifying headache. Imaging revealed an epidural empyema, necessitating urgent medical intervention. This case highlights the importance of early recognition and prompt management of sinusitis-related intracranial and orbital complications to prevent potentially life-threatening outcomes [5].

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2 cases of intracranial infections and one case of soft tissue edema without intracranial involvement from a single pediatric tertiary care center. Ultrasound findings revealed subgaleal fluid collections with associated periosteal lifting of the frontal bone in cases of Pott's Puffy tumor and intracranial infection, but no bony disruption or periosteal lifting in the patient with traumatic soft tissue edema. As pediatric intracranial infections may continue to have uncharacteristic seasonal peaks, POCUS may be considered as a first-line imaging technique for patients presenting with forehead swelling for differentiating infectious and traumatic etiologies as well as judging the need for further imaging techniques such as computed tomography and magnetic resonance imaging [6]

A toddler with acute sphenoid sinusitis presenting as status epilepticus with fever, intracranial abscess, and meningitis. Cerebrospinal fluid analysis suggested bacterial meningitis, but the polymerase chain reaction test was positive for human herpes virus 6 [7].

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