

## Subdural empyema as a complication of odontogenic sinusitis: A case report

Empiema subdural como complicação de sinusite odontogênica: Um relato de caso

Empiema subdural como complicación de sinusitis odontogénica: Reporte de un caso

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### **Abstract**

Odontogenic sinusitis represents between 10 and 40% of all cases of sinusitis in the population and may present with common symptoms such as nasal obstruction, anterior or posterior rhinorrhea, facial pain or pressure; and hypo- or anosmia. Although uncommon, intracranial and systemic suppurative complications have been previously reported in the literature and include brain abscess, epidural abscess and subdural empyema, associated with almost 100% morbidity and mortality, however, they are commonly related to meningitis, otogenic diseases and other sinus diseases. The aim of this study was to report a clinical case of intracranial subdural empyema associated with odontogenic infection in a previously healthy 17-year-old patient. This case highlighted the possibility of relevant complications, including even the patient's death, due to odontogenic sinusitis. Therefore, early dental planning and approach in a hospital environment are relevant and essential both in prevention and in the course of treatment, substantiating the multidisciplinary approach.

**Keywords:** Maxillary sinusitis; Empyema subdural; Dental focal infection.

### **Resumo**

As sinusites odontogênicas representam entre 10 e 40% de todos os casos de sinusite na população e podem apresentar sintomas comuns como obstrução nasal, rinorréia anterior ou posterior, dor ou pressão facial; e hipo ou anosmia. Embora incomuns, as complicações supurativas intracranianas e sistêmicas já foram relatadas previamente na literatura e incluíram abscesso cerebral, abscesso epidural e empiema subdural, associadas a quase 100% de morbimortalidade, no entanto, são comumente relacionadas à meningite, doenças otogênicas e outras sinusopatias. O objetivo deste estudo foi relatar um caso clínico de empiema subdural intracraniano associado à infecção odontogênica em um paciente de 17 anos, previamente hígido. Este caso evidenciou a possibilidade de complicações

relevantes, incluindo até mesmo a morte do paciente, por um quadro de sinusite odontogênica. Portanto, o planejamento e a abordagem odontológica precoces em ambiente hospitalar são relevantes e essenciais tanto na prevenção quanto no curso do tratamento, substanciando a abordagem multidisciplinar.

**Palavras-chave:** Sinusite maxilar; Empiema subdural; Infecção focal dentária.

### Resumen

La sinusitis odontogénica representa entre el 10 y el 40% de todos los casos de sinusitis en la población y puede presentarse con síntomas comunes como obstrucción nasal, rinorrea anterior o posterior, dolor o presión facial; e hipo o anosmia. Aunque las complicaciones supurativas intracraneales y sistémicas son infrecuentes y se han informado previamente en la literatura e incluyen absceso cerebral, absceso epidural y empiema subdural, asociadas con casi el 100% de morbilidad y mortalidad, sin embargo, comúnmente se relacionan con meningitis, enfermedades otogénicas y otras enfermedades de los senos paranasales. El objetivo de este estudio fue reportar un caso clínico de empiema subdural intracraneal asociado a infección odontogénica en un paciente de 17 años previamente sano. Este caso puso de relieve la posibilidad de complicaciones relevantes, incluyendo incluso la muerte del paciente por sinusitis odontogénica. Por lo tanto, la planificación y el abordaje odontológico temprano en el ambiente hospitalario son relevantes y esenciales tanto en la prevención como en el transcurso del tratamiento, fundamentando el abordaje multidisciplinario.

**Palabras clave:** Sinusitis maxilar; Empiema subdural; Infección focal dental.

## 1. Introduction

Rhinosinusitis is a common pathological alteration that affect maxillary sinuses and affects 45% to 70% of population, regardless of their origin. This condition may be originated through reactionary, neoplastic, traumatic process and microorganism infection (Workman et al., 2018). Sinusitis associated with infectious processes is classified according to the triggering factor, rhinosinusal when it is associated with rhinogenic infections and odontogenic when it is triggered by dental conditions. In fact, odontogenic infections represent 10 to 40% of all cases of sinusitis and is caused by odontogenic infections in the upper posterior teeth, the presence of dental materials and dental roots inside the maxillary sinus, and periodontal bone loss (Taschieri et al., 2015; Wuokko-landén et al., 2019).

Chronic complications of sinusitis are common and include nasal obstruction, anterior or posterior rhinorrhea, pain or facial pressure; and hypo- or anosmia (Zirk et al., 2017; Martu et al., 2022). Moreover, these complications are also classified as intracranial, extracranial or systemic complications. Considering these complications, intracranial complications rarely occur and have a worse prognosis (Gwaltney, 1996; Younis et al., 2002). The potential intracranial complications include non-suppurative conditions such as meningitis and cerebral venous sinus thromboses. Regarding to suppurative conditions, brain abscess, epidural abscess, and subdural empyema may be considered (Osborn & Steinberg, 2007; Ziegler et al., 2018).

Intracranial subdural empyema is characterized by presence of suppuration between dura and arachnoid layers of the meninges. This uncommon condition has been previously associated with almost 100% morbidity and mortality (Yoon & Redmon, 2019; Otto et al., 2021). However, the use of antibiotics resulted in significant reduction of these rates, now ranging from 14 to 28% (Meshref et al., 2022; Aukštakalnis et al., 2018). The aim of these study was to report a clinical case of intracranial subdural empyema associated to odontogenic infection.

## 2. Methodology

This article is a case report, approached in a descriptive and qualitative way (Pereira et al., 2018), in which information was obtained through laboratory and imaging tests and other relevant clinical observations found in medical and multidisciplinary records.

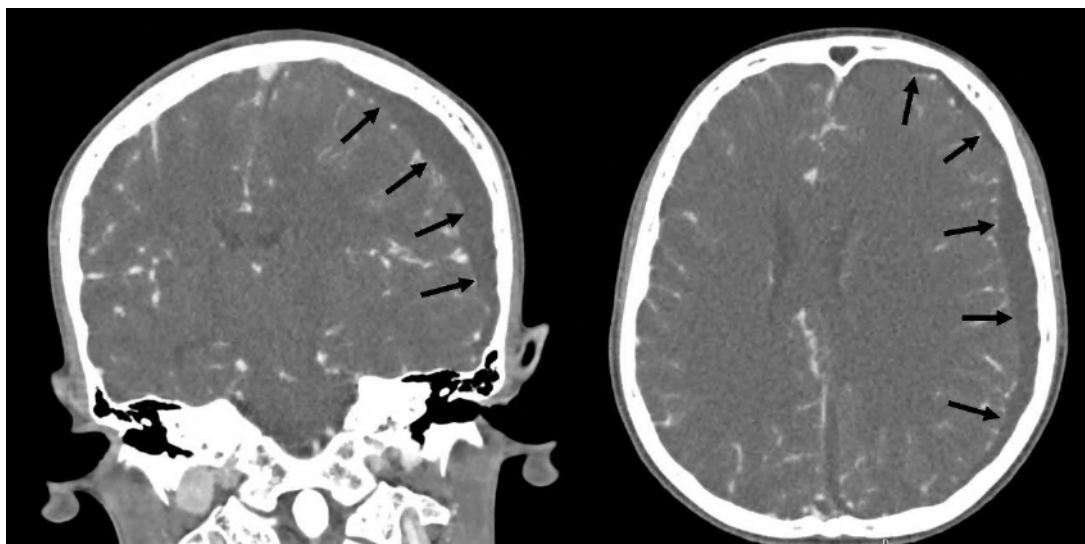
This study was developed taking into account the ethical principles described in the Declaration of Helsinki (World Medical Association, 1964), respecting resolution 466/2012, the CONEP/2018 circular letter (Ministry of Health, 2018) through the signing of the TCLE and approval from the Research Ethics Committee (CEP) of the State University of Ponta

Grossa under approval number: 6.455.184.

### 3. Case Report

A 17 years-old male patient was admitted to the emergency department of the Campos Gerais Regional University Hospital presenting headache and loss of strength in the right dimidius. The continuous hemicranial headache began 6 days before admission, evolving mental confusion and drowsiness. Family member denies allergies, comorbidities or drug use. On initial examination, the patient is assessed on the Glasgow Coma Scale (GCS) with a score of 13, spontaneous ventilation on room air, anisocoria, fever, mental confusion and poor dental condition. On this occasion, a CT scan of the skull revealed the presence of a purulent collection in the subdural space, with no evidence of recent bleeding, leading to the diagnostic hypothesis of subdural empyema (Figure 1).

**Figure 1** - Nonionic Iodinated Contrast CT demonstrating the presence of purulent collection in the left frontotemporoparietal region.



Source: Authors (2023).

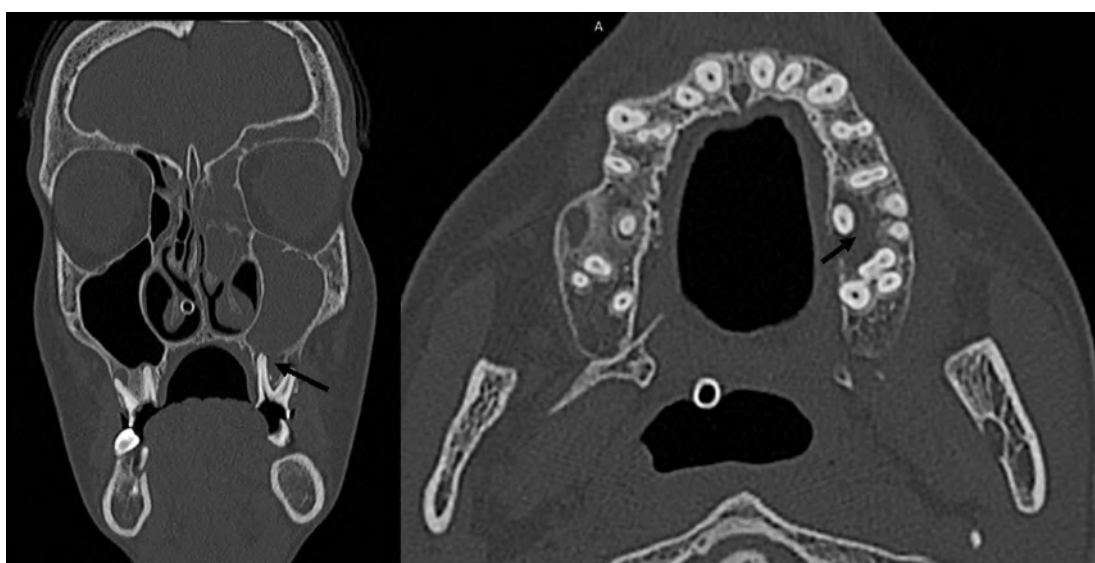
Thus, the patient was referred to the Intensive Care Unit for neurological monitoring. The blood count revealed the presence of leukocytosis ( $17,130/\text{mm}^3$ ), neutrophilia ( $13,704/\text{mm}^3$ ), and thrombocytopenia ( $100,000/\text{mm}^3$ ). The other CBC data were RBCs ( $4.30/\text{mm}^3$ ), hemoglobin ( $11.10/\text{mm}^3$ ), rods ( $343/\text{mm}^3$ ), lymphocytes ( $2,398/\text{mm}^3$ ), monocytes ( $514/\text{mm}^3$ ). The C-reactive protein dosage was  $29\text{mg/L}$ . Therefore, antimicrobial treatment was initiated with Ceftriaxone  $2\text{g } 12/12\text{hs}$  and Metronidazole  $500\text{mg } 6/6\text{hs}$ . Even after initiation of antibiotic therapy, the patient had a fever peak of  $39.3$  and positive Brudzinski's sign. The cerebrospinal fluid was collected and revealed a turbid aspect with 11 red blood cells, 125 leukocytes, 45% polymorphonuclear and 55% monomorphonuclear. Additionally, glucose and protein levels were 71 and  $103\text{mg/dl}$ , respectively.

The dental evaluation revealed the presence of residual roots, intense accumulation of dental calculus and biofilm, periodontal disease, and gingivitis. Patient presented a significant lowered level of consciousness (GCS 7), with bilateral mydriasis without photoreaction. At this moment, orotracheal intubation and emergency drainage of the left empyema were performed. During the procedure, there was ample drainage of purulent content. On the following day, there was a debit of 50ml in the drain, composed of sero-purulent fluid. On the second day after drainage, the drained content had a hemato-serous

aspect. After drainage, the patient was again referred to the Intensive Care Unit for care and maintenance of ongoing antibiotic therapy.

Based on tomographic sections, a communication of the upper molars with the maxillary sinus was observed, which presented exuberant purulent content (Figure 2). Thus, the hypothesis of odontogenic origin was considered. Therefore, on the third day of hospitalization (48 hours after the cranial content drainage procedure), serial extraction of elements 16, 25, 26, and 27 were performed, associated with direct access, direct and indirect drainage of the purulent collection with extensive extravasation of purulent content through the sinus and nasal cavities. The maxillary sinus was also explored by curettage and irrigation, followed by suturing of the alveoli and installation of a Penrose drain in the buccal maxillary sulcus.

**Figure 2** - CT demonstrating the opacification of the paranasal sinuses (maxillary, sphenoid and frontal) resulting from an inflammatory/infectious dental periapical lesion (Tooth 26).



Source: Authors (2023).

On the fifth day of hospitalization, after subdural drainage and dental extractions, antibiotic therapy was supplemented with Vancomycin 15mg/kg 8/8hs and Meropenem 2g 8/8hs. Hematological exams at that time showed leukocytosis (14,270/mm<sup>3</sup>), neutrophilia (11,844/mm<sup>3</sup>), and thrombocytopenia (83,000/mm<sup>3</sup>), showing a rod count of 2,140/mm<sup>3</sup>. Subsequently, the patient evolved with worsening of the neurological condition due to the severity of the empyema and presented positive signs for initiation of the brain death protocol. The brain death protocol presented a positive result on the sixth day of hospitalization with evolution to death.

#### 4. Discussion

Sinusitis as well as other infections of the respiratory and stomatognathic tracts are commonly diagnosed in clinical practice. Especially in the dental context, odontogenic sinusitis shows progressively increasing rates, possibly due to more accurate diagnostic strategies (Workman et al., 2018). In some cases, these infections are not limited to the sinuses and can affect other structures of the skull, leading to intracranial complications. Intracranial complications from this condition are not common. However, when they occur, they usually present an unfavorable prognosis (Meshref et al., 2022; Hallak et al., 2022). This clinical case reports the evolution of an odontogenic sinusitis to subdural empyema and characterizes the occurrence of intracranial complications.

Several studies have been reported that intracranial suppurative complications affects children and young adults with age ranging from 6 to 20 years old, associated to a slight male predominance. In addition, these complications are commonly related to meningitis, sinusitis and otogenic diseases (Nathoo et al., 1999, Osma et al., 2000; Penido et al., 2005; Zirk et al., 2017). Indeed, our clinical case reports the occurrence of an intracranial suppurative complication in a young 17-year-old male patient, associated to sinusitis. In cases of intracranial suppurative complication, 28% of the cases are associated with the previous establishment of sinusitis. Dental aspects should be evaluated since odontogenic infections represent 10 to 40% of all cases of sinusitis (Wuokko-Iandén et al., 2019).

In this clinical case, the suppurative condition was subdural empyema, characterized by the presence of suppuration between dura and arachnoid layers of the meninges (Yoon & Redmond, 2019). Treatment of subdural empyema usually includes broad-spectrum intravenous antibiotic therapy such as ceftriaxone, metronidazole, meropenem, and vancomycin. Antibiotic therapy should be started even empirically because the progression of the infectious process is really strong and can impair the prognosis. In addition, local drainage procedures are recommended to minimize infectious conditions. Both early diagnosis and prompt initiation of antibiotic therapy are decisive factors for more favorable clinical outcomes (Giannoni et al., 1997; Szyfter et al., 2018; Yoon & Redmond, 2019; Meshref et al., 2022; Wu et al., 2023).

In fact, the death of the patient in this case report is possibly associated with delayed care, since the patient was admitted to the hospital in exacerbated infectious conditions. In fact, the death of the patient in this clinical case corroborates previous studies reporting that subdural empyema is a potentially fatal condition with a rapid evolution (Yoon & Redmond, 2019; Meshref et al., 2022; Hallak et al., 2022). The care protocol performed included broad spectrum antibiotic therapy, associated with two drainage procedures (skull and maxillary sinus). The presence of the purulent collection that was initially located in the apex of the upper molars reached other regions of the cranial cavity. In this case report, the path of evolution was traced, beginning with the accumulation of purulent secretion in the paranasal sinus and followed to the cavernous sinus through the upper orbital fissure. In fact, this route of dissemination has been previously described, elucidating the possibility of a retrograde thrombophlebitis route as well as direct extension of disease through anatomic pathways such as existing foramina (Giannoni et al., 1997).

## 5. Final Considerations

This case report illustrates the possibility of relevant complications, including even patient death, from sinusitis of odontogenic origin. Indeed, it is not the evolution profile commonly observed. However, it is a critical situation that cannot be underestimated. In this context, the early dental approach in hospital environment is relevant both in prevention and treatment, strengthening the multidisciplinary approach.

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