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Pediatric Submandibular Abscess: Diagnostic Challenges and Comprehensive Management – A Literature Review

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ABSTRACT

Submandibular abscess in children is a rare deep neck space infection but can be fatal if diagnosis and management are delayed. Most cases (70–85%) originate from odontogenic infections of the mandibular molars, with Staphylococcus aureus and Streptococcus viridans as the predominant pathogens. This article reviews the etiology, early diagnosis, and management of pediatric submandibular abscesses based on recent literature (2020–2025) from Google Scholar, PubMed, and ScienceDirect. Anatomical and immunological differences in children lead to faster infection spread with nonspecific early symptoms; therefore, careful clinical examination and the use of CT scans or ultrasonography are crucial for early diagnosis. Management includes airway stabilization, culture-based broad-spectrum antibiotics, and timely surgical drainage. Multidisciplinary collaboration among dentists, ENT specialists, and pediatric anesthesiologists is essential to reduce morbidity and mortality. Prospective studies are needed to evaluate the effectiveness of minimally invasive approaches and current antibiotic resistance patterns in children. Early diagnosis, rational therapy, and interdisciplinary cooperation remain the key factors in achieving successful outcomes in pediatric submandibular abscess management.

1. INTRODUCTION

Submandibular abscess is a deep neck space infection characterized by inflammation and pus formation in the submandibular region. Approximately 70–85% of cases originate from odontogenic infections, while the remainder are caused by sialadenitis, lymphadenitis, trauma, or mandibular fractures (Ariobimo et al., 2023; Zam et al., 2024). The condition can progress rapidly and lead to severe complications, including airway obstruction, mediastinitis, and sepsis, with reported mortality reaching up to 40% even in the modern antibiotic era (Aryani et al., 2022).

The topic of deep neck space abscesses, particularly in the submandibular region, has become increasingly important. Globally, despite the availability of antibiotics, the incidence of severe complications such as airway obstruction, mediastinitis, and sepsis remains high. In developing countries, challenges such as delayed diagnosis, poor oral hygiene, and limited access to healthcare exacerbate the situation. An analytical study at Hasan Sadikin Hospital, Bandung, Indonesia, reported 113 cases of deep neck infections (not limited to children) between 2015 and 2019, with a significant mortality rate of 12.4% (Martanegara et al., 2023).

Specifically in the pediatric population, there has been a trend of increased incidence of deep neck abscesses following the COVID-19 pandemic (a twofold increase compared to pre-pandemic levels). Children are often diagnosed late due to non-specific early symptoms or inability to communicate effectively, leading to higher morbidity and mortality (Mäkinen et al., 2024). Studies in the United States report an incidence of 4.6 per 100,000 children for retropharyngeal/parapharyngeal abscesses, whereas in Indonesia, one study reported 2 per 100,000 children (Adil et al., 2020).

Compared with adults, children exhibit distinct characteristics: multispace involvement is much lower in children (7.5%) compared to adults (59.6%), and the dominant etiology may differ.

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In children, infections more often originate from the ear, nose, and throat, while in adults odontogenic sources predominate (Tezol & Alakaya, 2021). However, odontogenic infections remain a significant contributor, highlighting the importance of oral hygiene and preventive dental measures (Yankov et al., 2024). Although more common in adults, children are still at risk for submandibular abscesses, especially those with predisposing factors such as immunological or hematological disorders. A study at RSUP Prof. dr. R.D. Kandou Manado reported 7.7% of cases occurring in children aged 0–10 years (Mamuaya et al., 2013). Reports from RSUP Dr. Sardjito also documented odontogenic abscesses in children with idiopathic thrombocytopenic purpura (Utami et al., 2018). Globally, the submandibular space is reported as the most frequent abscess site in children, particularly under one year of age, with Staphylococcus aureus as the predominant pathogen (Thompson et al., 2002; El-Anwar et al., 2022). Anatomical and physiological differences in children further increase susceptibility. The submandibular space in children is relatively narrow, and connective tissue and fascia are more lax than in adults, allowing infections from the floor of the mouth or teeth to spread more easily into deep neck spaces (Perína et al., 2022; ENT Notes & Lectures, 2025). Additionally, the immature immune system and relatively abundant cervical lymphoid tissue often result in atypical inflammatory responses and more rapid infection dissemination (Queensland Children's Health, 2024; Magnetic Resonance Imaging Findings, 2022). These anatomical and physiological factors explain why submandibular abscesses in children can progress more aggressively than in adults, despite a lower overall incidence.

Clinically, common symptoms include fever, pain, submandibular swelling, trismus, dysphagia, and dysphonia. Accumulated pus at the floor of the mouth can elevate the tongue and worsen airway obstruction (Agarwal & Gupta, 2022). Diagnosis is established through history-taking, physical examination, and imaging (CT scan or ultrasonography), while pus culture guides appropriate antibiotic therapy. Management primarily involves airway stabilization, intravenous broad-spectrum antibiotics covering both aerobic and anaerobic bacteria, and surgical drainage once an abscess has formed. Incision may be performed intraorally, extraorally, or using a combined approach depending on the extent of infection. In pediatric patients, special attention is required for anesthetic management due to the risk of airway obstruction and physiological limitations (Depypere et al., 2020).

This review proposes a clinical algorithm for early diagnosis and comprehensive management of submandibular abscess in children based on recent literature. It will compare the effectiveness of imaging modalities (CT vs. USG, including MRI) in pediatric deep neck abscess diagnosis (e.g., sensitivity and specificity of USG vs. CT) (Smith et al., 2023; Jones et al., 2021), as well as the latest pediatric antibiotic options (e.g., resistance patterns and response to clindamycin/oxacillin) (Kharel et al., 2022). Furthermore, the review highlights pediatric anesthetic considerations during abscess drainage, including challenges of ventilation and intubation in children with deep neck infections causing airway obstruction or cervical tissue swelling (Swain, 2022; Ramazani et al., 2023). Although numerous publications discuss deep neck abscesses in adults, there is limited comprehensive review integrating early diagnosis, therapy, and anesthetic management specifically for children. Many studies focus on adults, while clinical, physiological, and management differences in pediatric patients remain insufficiently addressed. Therefore, the objective of this review is to provide a current synthesis of diagnostic approaches, imaging roles, antibiotic selection, airway management, and surgical techniques in children with submandibular abscesses. By emphasizing pediatric aspects, this review aims to improve clinical awareness, accelerate diagnosis, and guide safe and effective management strategies.

2. METHOD

This literature review examines the etiology, diagnostic challenges, and comprehensive management of pediatric submandibular abscesses using recent publications from 2020 to 2025. Relevant articles were identified through electronic databases, including PubMed, ScienceDirect, and Google Scholar, using predefined keywords such as "pediatric submandibular abscess," "deep neck space infection in children," "diagnostic imaging," "airway management," and "pediatric

anesthesia." Only peer-reviewed articles published in English that focused on pediatric populations (≤18 years) and discussed clinical presentation, diagnostic modalities, imaging findings, antimicrobial therapy, airway management, or surgical intervention were considered for inclusion.

Articles were screened based on relevance, availability of full-text, and clinical applicability. Studies focusing exclusively on adult populations, non-peer-reviewed publications, isolated case reports without broader clinical relevance, and articles lacking sufficient methodological detail were excluded. Data from the selected studies were extracted and synthesized narratively to summarize current evidence on diagnostic approaches, the role of imaging modalities, antibiotic selection, airway management strategies, and surgical techniques specific to pediatric submandibular abscesses. This descriptive synthesis aimed to highlight pediatric-specific considerations and identify gaps in existing literature..

3. RESULT AND DISCUSSION

Definition

The submandibular space consists of the sublingual and submaxillary spaces. The sublingual space is separated from the submaxillary space by the mylohyoid muscle. The submaxillary space is further divided into the submental and lateral submaxillary spaces by the anterior belly of the digastric muscle (Nurbaiti Iskandar et al., 2017). Submandibular swelling is commonly caused by dental abscesses from the second or third molars, whose roots lie below the attachment of the mylohyoid muscle. Abscesses can form in the submandibular space or its components as a continuation of infections from the head and neck region (Medscape, 2025).

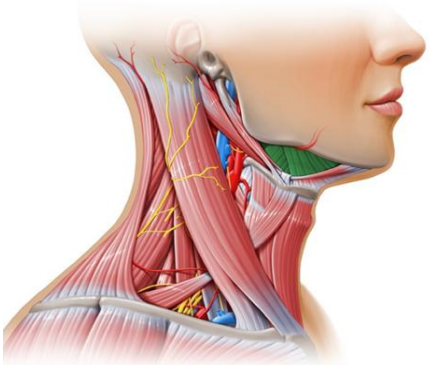

Figure 1. Anatomy of Submandibular Space (Kenhub, 2023)

Epidemiology

Submandibular abscesses can occur across all age groups, though they are more frequent in adults. A study at RSUP Prof. dr. R.D. Kandou Manado reported 7.7% of cases in children aged 0–10 years out of 39 total cases (Mamuaya et al., 2013). In Indonesia, a case report from RSUP Dr. Sardjito described a 14-year-old girl with idiopathic thrombocytopenic purpura (ITP) who developed an odontogenic submandibular abscess, with odontogenic infection contributing to 34.21% of cases (Utami et al., 2018). Globally, submandibular or submental abscesses are more common in children under one year of age (36%) compared with those over one year (23%), with Staphylococcus aureus being the most frequent pathogen (Thompson et al., 2002). Loose tissue structure and immature immune function are key predisposing factors (El-Anwar et al., 2022).

Incidence of pediatric deep neck space infections (DNSI) varies significantly by country and time period. For instance, a study in Japan reported an increase from 0.60 to 2.39 cases/month after the COVID-19 pandemic (Takahashi et al., 2025). Conversely, a center in Egypt (including children and adults) reported a smaller proportion of pediatric cases (20/80), with odontogenic etiology predominating and MRSA as the dominant pathogen (Nassar et al., 2022). These differences indicate that geography, healthcare access, and post-pandemic changes

influence epidemiology. However, data on Indonesian children remain very limited, highlighting a gap in Southeast Asian literature regarding current incidence and temporal trends.

Etiology

Infections may arise from teeth, floor of the mouth, pharynx, salivary glands, or submandibular lymph nodes, and may also extend from other deep neck spaces. Causative organisms are typically mixed aerobic and anaerobic bacteria (Nurbaiti Iskandar et al., 2017). Approximately 70–85% of cases are odontogenic, while the remainder are caused by sialadenitis, lymphadenitis, mucosal lacerations, or infected mandibular fractures (Zam et al., 2024). Studies have noted differences in dominant pathogens between children and adults or across regions. For example, Kharel et al. (2022) highlighted that empiric therapy with clindamycin/oxacillin is effective for pediatric deep neck infections in Nepal due to local resistance patterns, whereas studies from Egypt identified Staphylococcus aureus (including MRSA) as dominant in both pediatric and adult groups, differing from regions where Streptococcus viridans predominates in adults (Nassar et al., 2022). This variability underscores the need for region-specific pediatric treatment algorithms.

Pathogenesis

Submandibular abscesses typically originate from odontogenic infections of the second or third mandibular molars, spreading to the submandibular space if bone perforation occurs below the mylohyoid line (Malik, 2021). Other causes include submandibular sialadenitis, trauma, lymphadenitis, and infected mandibular fractures (Zam et al., 2024). The infection often involves aerobic bacteria (e.g., Streptococcus viridans) and anaerobic bacteria (e.g., Bacteroides, Peptostreptococcus), triggering inflammation, pus accumulation, and symptoms such as pain, trismus, and dysphagia (Aryani et al., 2022). Spread to parapharyngeal, retropharyngeal, or mediastinal spaces can cause severe complications like mediastinitis, airway obstruction, and systemic sepsis (Depypere et al., 2020; Jindal et al., 2018).

At the tissue level, aerobic and anaerobic bacteria induce IL-1β and TNF-α release, promoting neutrophil chemotaxis, vascular permeability, and exudate accumulation (Obaji et al., 2025). In children, relatively immature neutrophil function and low salivary IgA reduce mucosal defense efficacy, while active cervical lymphoid tissue facilitates lymphatic spread, accelerating abscess progression and increasing complication risk (World Journal of Pediatrics, 2021; Perína et al., 2022).

Clinical Manifestations

Symptoms include fever, neck pain, and submandibular or sublingual swelling, which may be fluctuant. Deep neck abscess should be suspected in patients with severe pain, history of dental procedures, upper respiratory infection, neck/mouth trauma, airway compromise, swallowing or speech difficulties, immunodeficiency, or rapid-onset/prolonged symptoms (McDowell et al., 2022). Warning signs include asymmetrical neck, masses or swelling, neck stiffness, trismus, tonsil/pharyngeal deviation, cranial nerve deficits, recurrent high fever, and respiratory distress (McDowell et al., 2022).

Diagnosis and Differential Diagnosis

Diagnosis relies on history, physical examination, and imaging. CT of the neck is the primary modality to evaluate infection extent and deep neck space involvement. In unstable patients, lateral portable neck X-ray may be used. Direct laryngoscopy helps assess airway involvement, and panoramic radiographs are indicated if dental origin is suspected. Laboratory workup includes blood cultures, pus cultures, coagulation, and electrolytes to guide diagnosis and treatment (McDowell et al., 2022). In children, imaging modality selection remains debated. Ultrasonography (USG) offers advantages of no radiation, lower cost, and wider availability in pediatric settings, making it suitable for superficial abscesses in stable children. However, USG sensitivity is limited (69.5%) compared with CT (95.5%), particularly for deep or multiloculated

abscesses; contrast-enhanced CT is recommended if USG results are ambiguous or airway compromise is suspected (Zhou et al., 2023; Ahuja et al., 2021).

Differential diagnoses include Ludwig's angina, suppurative cervical lymphadenitis, sialadenitis, ranula, parotitis, infected branchial anomalies, and Kawasaki disease with adenitis variant. Ludwig's angina is characterized by bilateral diffuse cellulitis of the mouth floor with tongue elevation and high airway obstruction risk (An et al., 2023). Suppurative cervical lymphadenitis presents as a painful unilateral mass caused by Staphylococcus aureus or Streptococcus pyogenes(Khodabandeh et al., 2025). Sialadenitis manifests as pain worsened during meals with pus from Wharton's duct (Adhikari et al., 2022). Ranula is a soft, painless cystic lesion from the sublingual gland, while branchial anomalies produce recurrent masses near the mandibular angle. Kawasaki disease with adenitis variant should be considered in children with fever >5 days and dominant cervical lymphadenopathy (Jone et al., 2024).

Management

Pediatric submandibular abscess management requires broad-spectrum antibiotics, appropriate drainage, and a multidisciplinary approach. High-dose parenteral antibiotics targeting both aerobic and anaerobic bacteria should be administered promptly, with empiric options including ampicillin-sulbactam or piperacillin-tazobactam for severe or suspected resistant cases. Carbapenems may be considered as second-line therapy for severe or immunocompromised cases, adjusted based on culture results and local resistance patterns (Kim et al., 2022; Lai et al., 2022). While culture-based therapy is recommended, empiric antibiotics remain critical due to high complication risk (Bandol et al., 2025; Kharel et al., 2022).

Abscess drainage can be performed via local incision for superficial abscesses or extraoral exploration under general anesthesia for deep or extensive abscesses, with incisions typically placed at the most fluctuant point or at the level of the hyoid bone (Nurbaiti Iskandar et al., 2017). Minimally invasive techniques, such as USG-guided needle aspiration, are increasingly popular in young children due to safety, reduced morbidity, and shorter hospital stays. Open incision and drainage remain preferred for large, multiloculated, or anatomically challenging abscesses (Goud et al., 2025; Lee et al., 2021).

Airway management is critical, particularly in children with trismus or airway-threatening abscesses. Video laryngoscopy or fiberoptic intubation increases first-pass success and reduces complications compared with conventional laryngoscopy (Van Der Walt et al., 2021; Schauer et al., 2019). In severe cases or airway obstruction, ICU involvement is essential, including preparation for intubation, mechanical ventilation, and management of complications such as mediastinitis or sepsis (Perína et al., 2022). A multidisciplinary team involves dental/maxillofacial surgeons, ENT/head-neck surgeons, pediatric anesthesiologists, and ICU personnel if required (Glavan et al., 2025). Challenges in children include difficult airway management, imaging limitations due to patient cooperation or need for sedation, and age- or weight-adjusted antibiotic dosing considering local resistance patterns (Kiss et al., 2023; Airway Management in Pediatrics, 2024).

In mild cases, early discharge protocols may be applied with strict selection criteria, particularly for small abscesses successfully treated with minimally invasive drainage, provided the child is stable, with close monitoring, family education, and follow-up (Lee et al., 2023). Overall, a comprehensive management strategy involving rapid screening, rational antibiotics, timely drainage, airway preparedness, and adaptive hospitalization protocols can reduce morbidity, accelerate recovery, and enhance patient safety.

Complications

Although pediatric submandibular abscess prognosis is generally good, delayed management can lead to serious complications. Major complications include airway obstruction due to submandibular edema, tongue elevation, or pus rupture, which may result in asphyxia. Infection can also spread to temporal, buccal, periorbital, or mediastinal spaces, as reported in cases extending to temporal and periorbital regions (Zam et al., 2024). Trismus and pain can

impair nutrition and sleep, and undetected mandibular fractures may lead to osteomyelitis or impaired bone healing (Jindal et al., 2018).

Prognosis

Prognosis in children is excellent with early diagnosis and comprehensive management, including drainage, intravenous antibiotics, and elimination of the infection source via tooth extraction. Most case reports show complete recovery without recurrence following combined medical and surgical therapy (Agarwal & Gupta, 2022; Zam et al., 2024). Tooth extraction concurrent with drainage accelerates healing and shortens hospital stay (Gazali et al., 2023)..

4. CONCLUSION

Pediatric submandibular abscess is a rare deep neck infection that can be life-threatening if diagnosis and management are delayed. Literature indicates that most cases are odontogenic from mandibular molars and involve mixed aerobic–anaerobic flora. Anatomical and immunological differences in children facilitate faster infection spread, while early symptoms are often non-specific, making early detection a key clinical challenge. Careful physical examination, supported by imaging (CT or USG) and pus culture, is crucial for accurate diagnosis.

Comprehensive management includes airway stabilization, intravenous broad-spectrum antibiotics tailored to culture results, and timely surgical drainage. Combined drainage and elimination of odontogenic infection sources accelerate recovery and prevent recurrence. Synthesis of studies highlights the importance of multidisciplinary collaboration among dental surgeons, ENT specialists, pediatric anesthesiologists, and pediatric intensive care teams to reduce morbidity and mortality. Implementation of evidence-based protocols, including early airway risk assessment and close postoperative monitoring, is a critical component of holistic management.

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