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MODERN SURGICAL AND CONSERVATIVE APPROACHES IN THE TREATMENT OF SUBMANDIBULAR PHLEGMON

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Abstract

Submandibular phlegmon is a severe purulent-inflammatory condition affecting the submandibular space and adjacent fascial compartments, often originating from odontogenic infections. The rapid spread of infection and risk of life-threatening complications such as airway obstruction and sepsis necessitate timely diagnosis and comprehensive treatment. This article analyzes modern surgical and conservative approaches in the management of submandibular phlegmon, focusing on antibiotic therapy, drainage techniques, and operative interventions. Evidence-based data from contemporary clinical studies are reviewed to evaluate treatment outcomes and optimize management strategies.

Keywords

Submandibular phlegmon, odontogenic infection, antibiotics, surgical drainage, cervicofacial infections, abscess, sepsis, maxillofacial surgery

Introduction

Submandibular phlegmon represents a diffuse purulent inflammation of the submandibular space, frequently caused by odontogenic infections, particularly from mandibular molars [1]. Due to anatomical proximity to vital structures such as the airway and major vessels, the condition can rapidly progress into deep neck infections, mediastinitis, or septic complications [2].

The incidence of cervicofacial infections remains significant despite advances in dental care and antibiotic therapy. Studies indicate that odontogenic infections account for approximately 70–90% of deep neck infections [3]. The polymicrobial nature of these infections, involving both aerobic and anaerobic bacteria, complicates treatment and requires a combined therapeutic approach [4].

Modern management strategies emphasize early diagnosis, appropriate antibiotic therapy, and timely surgical intervention to prevent complications.

Methodology

This study is based on a systematic review of clinical literature published between 2010 and 2024, focusing on the management of submandibular phlegmon. Sources include peer-reviewed journals in maxillofacial surgery, otolaryngology, and infectious diseases.

Inclusion criteria:

- Clinical studies on deep neck infections and submandibular phlegmon
- Studies evaluating antibiotic regimens and surgical interventions
- Meta-analyses and randomized controlled trials

Exclusion criteria:

- Case reports without clinical relevance
- Non-English publications lacking verified data

Data were analyzed comparatively, focusing on treatment outcomes, complication rates, and recovery periods.

Results

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Analysis of the reviewed literature demonstrates that combined surgical and conservative treatment provides the best outcomes in submandibular phlegmon management.

Antibiotic therapy remains the cornerstone of conservative management. Broad-spectrum antibiotics such as amoxicillin-clavulanate, clindamycin, and metronidazole are commonly used to target mixed aerobic and anaerobic flora [5]. Empirical therapy is initiated immediately and later adjusted based on culture and sensitivity results [6].

Surgical drainage is indicated in most cases due to the diffuse nature of phlegmon. Studies show that early incision and drainage significantly reduce hospitalization time and complication rates [7].

Operative techniques vary depending on the extent of infection. Extraoral incisions in the submandibular region allow effective drainage and prevent spread to deeper spaces [8]. In severe cases, multiple incisions and placement of drains are required.

Airway management is a critical aspect of treatment. In cases of airway compromise, tracheostomy or intubation is necessary [9].

Analysis and Discussion

The management of submandibular phlegmon remains a complex clinical challenge that requires a comprehensive, multidisciplinary approach integrating surgical, antimicrobial, and supportive strategies. The reviewed literature consistently emphasizes that successful outcomes depend on early diagnosis, prompt initiation of therapy, and the appropriate combination of conservative and surgical interventions. This section provides an in-depth analysis of the key aspects influencing treatment outcomes, including pathophysiology, antimicrobial therapy, surgical techniques, airway management, and complication prevention.

One of the most critical considerations in submandibular phlegmon is the anatomical complexity of the submandibular space and its communication with adjacent fascial compartments. The submandibular space is divided into sublingual and submaxillary spaces by the mylohyoid muscle, and infections can easily spread between these compartments and into deeper cervical spaces [1]. This anatomical connectivity explains the rapid progression of infection and highlights why localized treatment approaches are often insufficient. The diffuse nature of phlegmon, as opposed to a well-encapsulated abscess, further complicates management because it lacks clear boundaries, allowing infection to infiltrate surrounding tissues extensively [2].

From a microbiological perspective, submandibular phlegmon is typically polymicrobial, involving a mixture of aerobic and anaerobic organisms. Common pathogens include viridans group streptococci, Staphylococcus aureus, Peptostreptococcus species, and anaerobes such as Bacteroides and Fusobacterium [11]. The synergistic interaction between aerobic and anaerobic bacteria enhances virulence and contributes to tissue destruction, which underscores the necessity for broad-spectrum antibiotic coverage. Empirical antibiotic therapy must therefore target both groups effectively until culture and sensitivity results are available.

However, despite the importance of antimicrobial therapy, numerous studies have demonstrated that antibiotics alone are rarely sufficient to resolve submandibular phlegmon [10]. This is primarily due to the poor penetration of antibiotics into necrotic tissue and purulent collections, as well as the presence of biofilms that protect bacteria from antimicrobial agents. Additionally, the acidic environment within infected tissues can reduce antibiotic efficacy. These limitations strongly support the need for surgical intervention as a fundamental component of treatment.

Surgical drainage remains the cornerstone of management and is widely regarded as the gold standard in treating submandibular phlegmon. Early surgical intervention has been shown to

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significantly reduce morbidity, shorten hospital stays, and prevent the progression of infection to life-threatening complications [7]. The timing of surgery is crucial; delays in intervention can result in the spread of infection to deep neck spaces, increasing the risk of mediastinitis and sepsis. Evidence suggests that patients who undergo drainage within the first 24–48 hours of diagnosis have markedly better outcomes compared to those with delayed treatment.

The choice of surgical technique depends on the extent and location of the infection. Extraoral approaches are generally preferred for submandibular phlegmon, as they provide better access for adequate drainage and reduce the risk of intraoral contamination [8]. Incisions are typically made parallel to the inferior border of the mandible to avoid injury to the marginal mandibular branch of the facial nerve. Blunt dissection is then used to explore the infected spaces and break down loculations, followed by the placement of drains to facilitate continuous evacuation of purulent material.

In extensive infections involving multiple fascial spaces, multiple incisions and through-and-through drainage may be necessary. The use of passive drains, such as Penrose drains, or active suction drainage systems depends on surgeon preference and the severity of infection. Continuous irrigation of the wound with antiseptic solutions has also been recommended in some studies to enhance bacterial clearance and promote healing.

Minimally invasive techniques, including ultrasound-guided drainage, have gained attention in recent years as potential alternatives to traditional open surgery [12]. These techniques offer advantages such as reduced tissue trauma, shorter recovery times, and improved cosmetic outcomes. However, their applicability is limited to selected cases with well-localized collections. In diffuse phlegmon, where infection spreads extensively without clear abscess formation, open surgical drainage remains the most reliable and effective approach.

Airway management is another critical aspect of treating submandibular phlegmon. Due to the proximity of the infection to the airway, patients are at significant risk of airway obstruction caused by edema, tongue elevation, and compression of surrounding structures. Clinical signs such as dysphagia, dyspnea, stridor, and drooling indicate impending airway compromise and require immediate intervention [9].

Endotracheal intubation may be challenging in these patients due to limited mouth opening (trismus) and distorted anatomy. Awake fiberoptic intubation is often recommended as a safer alternative. In severe cases, tracheostomy may be necessary to secure the airway. Early involvement of anesthesiologists is essential to ensure safe airway management and reduce perioperative risks.

Another important consideration in the management of submandibular phlegmon is the elimination of the primary source of infection. In most cases, this involves odontogenic foci such as infected mandibular molars. Failure to address the source of infection can lead to persistent or recurrent disease. Tooth extraction or endodontic treatment should be performed once the patient's condition stabilizes, although in some cases, simultaneous removal during surgical drainage may be appropriate.

The role of imaging in diagnosis and treatment planning is also significant. Contrast-enhanced computed tomography (CT) is considered the gold standard for evaluating deep neck infections, as it provides detailed information about the extent of infection, presence of abscess formation, and involvement of adjacent structures [3]. Imaging findings help guide surgical decision-making and allow clinicians to identify complications early.

Complications associated with submandibular phlegmon remain a major concern despite advances in treatment. Ludwig's angina, a rapidly spreading cellulitis involving the submandibular, sublingual, and submental spaces, is one of the most severe forms of the disease

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and can lead to fatal airway obstruction if not managed promptly. Other complications include mediastinitis, septic shock, internal jugular vein thrombosis, and disseminated infection [2].

The reported mortality rate for deep neck infections has decreased significantly with modern medical care but still ranges between 1% and 5% in severe cases, particularly in patients with comorbidities such as diabetes mellitus, immunosuppression, and advanced age [2]. These findings highlight the importance of early recognition, aggressive treatment, and close monitoring.

Postoperative management plays a crucial role in ensuring successful recovery. Continued antibiotic therapy is necessary to eliminate residual infection and prevent recurrence. The duration of antibiotic treatment typically ranges from 7 to 14 days, depending on clinical response and severity of infection [6]. Wound care, including regular dressing changes and monitoring of drainage, is essential to promote healing and detect any signs of complications.

Supportive care measures, such as adequate hydration, nutritional support, and pain management, are also important components of treatment. Patients with severe infections may require hospitalization in intensive care units for close monitoring and management of systemic complications.

Recent advances in medical technology and treatment strategies have contributed to improved outcomes in submandibular phlegmon. The development of more effective antibiotics, improved imaging techniques, and refined surgical methods have all played a role in reducing morbidity and mortality. However, challenges remain, particularly in resource-limited settings where access to advanced diagnostic tools and specialized care may be limited.

In addition, antibiotic resistance is an emerging concern that may impact the effectiveness of empirical therapy. The increasing prevalence of resistant bacterial strains necessitates careful selection of antibiotics and emphasizes the importance of culture-guided therapy. Ongoing research into novel antimicrobial agents and alternative treatment strategies is essential to address this issue.

Another area of interest is the role of preventive measures in reducing the incidence of submandibular phlegmon. Improved dental hygiene, regular dental check-ups, and early treatment of odontogenic infections can significantly reduce the risk of developing severe cervicofacial infections. Public health initiatives aimed at increasing awareness of oral health and access to dental care are therefore important in preventing this condition.

Conclusion

Submandibular phlegmon is a serious medical condition requiring prompt and comprehensive treatment. The combination of early antibiotic therapy and timely surgical drainage provides the most effective outcomes. Modern approaches emphasize individualized treatment plans based on infection severity and patient condition.

Advances in diagnostic imaging, antimicrobial therapy, and surgical techniques have significantly improved prognosis. However, early intervention and proper management remain critical to preventing life-threatening complications.

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