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Monaldi Arch Chest Dis 2026 [Online ahead of print]

To cite this Article:

Eshiev A, Azimbaev N, Eshieva A, et al. **Clinical significance of secondary purulent mediastinitis from odontogenic and tonsillogenic origins.** *Monaldi Arch Chest Dis* doi: 10.4081/monaldi.2026.3744

Submitted: 26-09-25

Accepted: 21-09-2026

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Clinical significance of secondary purulent mediastinitis from odontogenic and tonsillogenic origins

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Conflict of interest: the authors declare that no conflict of interest.

Ethics approval and consent to participate: the study was approved by the Ethics Commission of the Osh State University. No 67584.

Informed consent: informed consent was obtained from all individuals included in this study.

Patient consent for publication: not applicable.

Availability of data and materials: all data generated or analyzed during this study are included in this published article.

Declaration of generative artificial intelligence and artificial intelligence-assisted technologies in the writing process: the authors did not use AI tools or technologies to prepare this manuscript.

Abstract

The aim of this study was to enhance early diagnostic methods and improve the efficacy of surgical intervention in patients with secondary purulent mediastinitis of odontogenic and tonsillogenic origin through the introduction of novel drainage techniques and surgical approaches. The study methodology involved an analysis of clinical cases of acute purulent mediastinitis of odontogenic and tonsillogenic origin, divided into two groups: the main group (40 patients treated with new methods) and the control group (20 patients treated with traditional methods). Surgical treatment in the main group included the drainage of purulent-necrotic foci via external approaches with active drainage systems. For odontogenic forms, a "P"-shaped approach was employed, facilitating effective pus drainage and providing an improved surgical field overview. For tonsillogenic forms, the Kanshin method was utilized to drain the posterior mediastinum. Treatment was further complemented by antibacterial therapy, electrolyte balance correction, and ventilatory support when required. The results demonstrated that the combined use of these surgical methods yielded high treatment efficacy. All patients who underwent timely surgical intervention and received antibacterial therapy exhibited positive outcomes, allowing their discharge from hospital in satisfactory condition. The study's conclusions underscore the critical importance of early diagnosis, the appropriate selection of surgical techniques, and the integration of multidisciplinary treatment approaches. Emphasis is placed on the necessity of active drainage of purulent-inflammatory foci, tailored surgical approaches based on the localization of the pathology, the application of modern diagnostic methods, and close collaboration between maxillofacial and thoracic surgeons to achieve optimal therapeutic outcomes.

Key words: infectious and inflammatory diseases, surgical intervention, purulonecrotic foci, drainage, antiseptic therapy.

Introduction

Secondary purulent mediastinitis caused by odontogenic and tonsillogenic infections remains one of the most severe mediastinal complications, necessitating urgent surgical intervention and intensive care. The prevalence of these conditions is increasing, highlighting the need for a deeper understanding of their aetiology and pathogenesis, as well as the development of advanced diagnostic and treatment methods. Without timely detection and adequate therapy, mediastinitis can result in severe complications, such as sepsis, organ failure, and other life-threatening conditions.

Odontogenic purulent mediastinitis is among the most common forms of secondary mediastinal infections, arising from inflammatory processes in the oral cavity [1]. This condition is typically caused by periodontitis, complicated by periostitis or osteomyelitis of the lower jaw, leading to the development of phlegmon in the palatine and pterygoid regions of the jaw, as well as phlegmon of the floor of the mouth. These infections can spread into the mediastinum through the fascial spaces of the neck. A study by D.S. Avetikov et al. reported an increase in the incidence of odontogenic phlegmon, identifying it as an urgent clinical challenge requiring a comprehensive treatment approach [2]. The authors highlighted the significance of considering patients' biorhythms, which improved treatment outcomes by optimising the timing of medication administration and surgical interventions. The study emphasised the importance of individualising therapeutic approaches, including tailoring treatment methods based on the severity of the patient's condition, disease progression, and the patient's physiological reactivity. Additionally, the authors stressed the necessity of integrating modern technologies and updated treatment protocols to minimise complications and improve prognosis. However, the study lacked specific quantitative data that could further validate its findings.

The increasing incidence of tonsillogenic mediastinitis, a complication arising from tonsillitis or paratonsillitis, was also identified as a critical clinical issue. In these cases, the infection spreads from the oropharyngeal space through the oesophageal tissue, causing severe inflammatory processes in the posterior mediastinum. According to R.M. Li and M. Kiemeney [3], the incidence of tonsillogenic mediastinitis has risen by 15% over the past decade, underlining the need for improved diagnostic and therapeutic approaches. Their analysis of clinical data demonstrated the effectiveness of a combined treatment strategy, including surgical drainage of purulent mediastinal foci and antibacterial therapy targeting the infectious agent. Furthermore, the study noted that timely diagnosis and early initiation of

intensive care significantly reduced the risk of complications and improved clinical outcomes. Research underscores that a combination of conservative and surgical methods is essential for mitigating the risk of severe complications, such as mediastinitis, and for reducing patient mortality. Anaerobic bacteria play a pivotal role in the pathogenesis of odontogenic and tonsillogenic mediastinitis, spreading along the neurovascular bundles of the neck and peritracheal tissue, thereby inducing severe inflammation. The rapid progression of infection and its capacity for tissue necrosis are critical factors.

K. Thompson and J. Connor reported that infections caused by nonclostridial anaerobes are particularly challenging to diagnose and treat due to their rapid spread [4]. According to their study, these infections can progress at a rate of 2-3 cm per hour into adjacent tissues, making it difficult to monitor the disease's progression in a timely manner. This rapid spread frequently results in severe complications, including sepsis, which occurs in up to 20% of cases among patients with nonclostridial anaerobic infections. The findings highlighted the critical importance of early diagnosis, aggressive surgical debridement of affected tissues, and the administration of broad-spectrum antibacterial drugs. The authors emphasised that managing such infections requires not only prompt diagnosis but also the implementation of specialised treatment strategies to effectively control the infection at all stages of its progression.

An important contribution to the field is the study by X. Guan et al. [5], who proposed a novel classification system for descending necrotising mediastinitis and outlined appropriate surgical strategies for its treatment. The authors emphasised the significance of selecting the correct approach for drainage based on the localisation of the infection within the mediastinum, as each type of mediastinitis has distinct characteristics and necessitates an individualised treatment strategy. This review formed the foundation for improving surgical intervention techniques and the drainage of purulent-inflammatory processes, particularly for patients experiencing a complicated course of the disease. The study also underscored the necessity of an interdisciplinary approach, involving collaboration between surgeons, otolaryngologists, and infectious disease specialists.

Similarly, the work of C.Y. Ho et al. provides a comprehensive analysis of treatment methods for descending necrotising mediastinitis caused by infections originating in the neck. This study identified key strategies for managing this severe pathology [6]. The authors highlighted that one of the essential elements of effective treatment for such cases is the adoption of a multidisciplinary approach. This involves close collaboration between various

medical specialists and hospital departments to ensure coordinated care. The integration of surgical, infectious diseases, and intensive care teams facilitates the optimisation of treatment protocols, reduces delays in initiating therapy, and enhances the overall effectiveness of care. Such an integrated approach has been shown to significantly lower mortality rates and improve the clinical outcomes of patients with this life-threatening complication.

The study by D.M. Almutairi et al. underscores the critical importance of early diagnosis and surgical intervention in managing deep neck infections that may lead to mediastinitis [7]. The authors highlight that thorough medical history-taking and rapid identification of infectious sources are key elements in successfully treating patients at heightened risk of developing severe complications. The high mortality rate and challenges associated with treating mediastinitis arising from neck infections are also discussed in the study by M. Yano et al. [8]. Their work explores the spread of descending necrotising mediastinitis and emphasises the importance of effective drainage techniques tailored to the infection's localisation within the mediastinum. A detailed understanding of this pathology is essential for developing more effective treatment strategies and improving clinical outcomes in patients facing such severe complications.

The work of R. La Russa et al. addresses the complexities of diagnosing post-traumatic meningitis, which can be challenging to detect during its early stages [9]. Their review highlights the importance of precise diagnosis and an understanding of inflammatory processes in patients who may harbour mixed infections. The authors stress that syndromes associated with post-traumatic infections should be carefully considered when diagnosing mediastinitis, especially in cases where additional factors, such as trauma or prolonged immobilisation, are present. The study emphasises the need for a comprehensive approach to mediastinitis treatment, which involves addressing potential complications at all stages of therapy. Early identification of the disease's primary manifestations and proactive management of complications – such as sepsis, respiratory failure, and infection spread to adjacent tissues – are crucial for optimising treatment. A holistic approach to treatment should integrate diverse methods, foster collaboration among multidisciplinary teams, and leverage modern technologies to achieve effective patient management. This strategy not only minimises the risks of further complications but also ensures better overall control of the patient's condition and enhances treatment outcomes.

A significant contribution to the development of treatment methods is the study by K. Sugio et al. [10], who introduced a novel classification system for descending necrotising

mediastinitis and proposed enhanced drainage techniques based on the localisation of the infectious process. Their findings indicate that adopting these new approaches to drainage can substantially reduce the risk of infection spread and shorten treatment duration. Of particular note is their concept of optimising surgical access to the mediastinum, which has a direct impact on the effectiveness of surgical interventions. This study highlights the practical importance of tailoring treatment approaches to the type and extent of infection, which is crucial for the successful management of purulent mediastinitis. The work of T. Gehrke et al. also makes a valuable contribution by analysing the treatment of deep neck infections with mediastinal complications [11]. Their study, which included 218 patients, offers extensive data for evaluating the efficacy of various treatment strategies and predicting outcomes. The authors demonstrate that timely diagnosis and adequate surgical interventions, including effective drainage and antimicrobial therapy, significantly lower mortality rates and improve clinical outcomes. T. Gehrke et al. emphasise the importance of a multidisciplinary approach in managing such complex conditions, involving collaboration between otolaryngologists, surgeons, and infectious disease specialists. This approach underscores the necessity of incorporating modern drainage techniques into routine medical practice to enhance therapeutic effectiveness and minimise the risk of complications.

Thus, rising incidence of secondary purulent mediastinitis caused by odontogenic and tonsillogenic infections presents new challenges to medical science. The diverse aetiological factors and varying pathways of disease progression necessitate a comprehensive study of the pathogenesis, refinement of diagnostic methods, and the development of effective treatment strategies. An analysis of scientific studies underscores the critical importance of early detection of purulent mediastinitis, as well as the necessity of a multidisciplinary approach. This approach involves close collaboration among maxillofacial and thoracic surgeons, infectious disease specialists, and otolaryngologists. Despite significant progress in understanding and managing this pathology, unresolved questions remain regarding optimal drainage techniques, the selection of surgical methods, and therapeutic strategies based on the localisation of the infection and the patient's condition severity. The study aimed to identify the key factors influencing the development and severity of secondary purulent mediastinitis of odontogenic and tonsillogenic origin. A particular focus was placed on optimising preventive measures, facilitating early intervention, and improving patient rehabilitation to minimise the risk of complications.

Literature review

A study of a rare case of Lemierre's syndrome, arising from a multidrug-resistant dental abscess, highlighted the complexity of mediastinitis associated with odontogenic infections. G. D'Erme et al. reviewed the critical importance of early diagnosis and aggressive treatment to prevent complications such as sepsis and Lemierre's syndrome, which can develop from dental infections [12]. This case exemplified the challenges of treating patients with multidrug-resistant bacteria, necessitating tailored therapeutic approaches based on the specific characteristics of the infection.

Subsequent studies have further emphasised the importance of prompt intervention in cases of mediastinitis. A. Kimura et al. investigated the clinical prognosis of mediastinitis following deep neck infections [13]. The authors identified major risk factors for mediastinitis, including infection severity, involvement of multiple neck spaces, patient age, and overall health condition. Their findings facilitated the identification of patients requiring active monitoring and timely surgical intervention to prevent the spread of infection to the mediastinum. An important study conducted by F. Ricciardiello et al. proposed a decision-making algorithm for managing patients with multiple space infections of the neck [14]. This research contributed to the improved management of mediastinitis by clearly defining criteria for selecting optimal therapeutic and surgical approaches based on the extent of the infection. The application of this algorithm significantly reduced the risk of complications and improved treatment outcomes.

B. Pastene et al. reviewed approaches to managing mediastinitis in intensive care settings, emphasising the necessity of early detection and aggressive treatment in critically ill patients [15]. They highlighted that without adequate drainage and infection control, mediastinitis can result in severe complications and high mortality rates among intensive care unit patients. Deep neck infections, particularly those of odontogenic origin, are potentially life-threatening conditions requiring prompt diagnosis and treatment. In their study, M. Pesis et al. provided a detailed review of the presentation and management of infections arising from dental issues, such as periodontitis, abscesses, and other deep infections that may extend through the fascial spaces of the neck to deeper anatomical regions [16]. The authors stressed the importance of early detection, as the symptoms of these infections may be nonspecific, complicating diagnosis. Modern imaging techniques, including computed tomography (CT) and magnetic resonance imaging (MRI), were identified as essential tools for accurately assessing the extent of the infection. Treatment primarily involves surgical

intervention, including drainage and decontamination of affected areas, combined with broad-spectrum antibiotic therapy. The outlined diagnostic and treatment strategies significantly enhance clinical outcomes. However, odontogenic neck infections remain a serious threat to patients, underscoring the need for early referral and close collaboration between dental and medical professionals to prevent severe complications.

A study by M. Taylor et al. analysed mediastinitis following neck infections, highlighting the importance of a multidisciplinary approach to managing this pathology [17]. The authors stressed the necessity of coordination among surgeons, infectious disease specialists, and anaesthesiologists to achieve better outcomes in complex cases of mediastinitis. This finding aligns with the broader consensus on integrating different specialists to ensure comprehensive patient care. Similarly, F. Cambria et al. explored the successful management of odontogenic and non-odontogenic neck infections, emphasising the value of a multidisciplinary approach [18]. Their study highlighted the coordination among surgeons, infectious disease specialists, otolaryngologists, and other experts to optimise treatment outcomes. The authors underscored the significance of timely surgical intervention in preventing complications such as mediastinitis and sepsis, demonstrating the critical need for prompt medical response. A study by C. Ma et al. examined the multidisciplinary management of deep neck infections associated with mediastinitis within a single medical centre [19]. The authors stressed the importance of early diagnosis and multidisciplinary collaboration in reducing the mortality associated with these infections. Their findings confirmed that active treatment – including surgical drainage, antibiotic therapy, and life support – is pivotal for the successful management of patients with mediastinitis.

A. Rzepakowska et al. analysed factors affecting the effectiveness of surgical treatment for purulent deep space infections of the neck [20]. Their study highlighted the importance of timely drainage of infected areas, the use of modern antibiotics, and the experience of the surgical team. The authors also emphasised the role of early detection and surgical intervention in preventing the spread of infection to the mediastinum, underscoring the need for rapid and precise medical action. M. Del Prado Venegas Pizarro et al. reviewed strategies to reduce the high mortality rates associated with mediastinitis [21]. They emphasised the importance of early diagnosis, intensive treatment, and optimised surgical approaches in significantly lowering the risk of fatal complications, particularly when mediastinitis is combined with deep neck infections. F. Del Duca et al. analysed the role of forensic experts in determining the causes of death resulting from anaphylactic reactions,

which may be relevant to understanding deaths associated with sepsis and mediastinitis [22]. The authors highlighted the need for accurate diagnosis in cases where severe allergic reactions might complicate the clinical course of the disease. Their findings further underscored the importance of a precise and comprehensive diagnostic approach in managing complex infectious pathologies.

A recent study by J.S. Yun et al. explored the surgical treatment of mediastinitis, particularly in the context of managing deep neck infections [23]. The authors highlighted the critical role of meticulous patient monitoring and collaboration between specialties to ensure successful treatment outcomes for mediastinitis. M. Galli et al. investigated chronic maxillary sinusitis of odontogenic origin and associated oroantral fistulas [24]. They reported the success of a combined surgical approach that addressed both sinusitis and fistula repair. This study underscored the effectiveness of a multidisciplinary approach in managing complex cases where odontogenic infections resulted in long-term complications. S. Vilén et al. compared the characteristics and severity of odontogenic bacterial infections with other bacterial infections in the oropharynx [25]. Their findings revealed distinct differences in the pathogenesis and severity of odontogenic infections, necessitating specialised treatment and patient monitoring strategies. In their study, Z. Zhao et al. analysed the surgical management and treatment outcomes of mediastinitis caused by odontogenic infections in the Chinese population [26]. The authors presented clinical data on surgical techniques, emphasising the importance of early intervention and thorough postoperative follow-up to reduce mortality rates.

Z. Del Fante et al. examined the risks associated with necropsy and mortuary activities, providing insights relevant to understanding general risks linked to mediastinitis and other inflammatory processes in the thoracic region, particularly in patients with sepsis [27]. This study highlights the importance of thoroughly analysing potential risks in the context of inflammatory diseases. Acute infections of the fascial spaces in the neck are serious conditions that require prompt diagnosis and treatment. In a study by S. Prabhu and E. Nirmalkumar [28], which followed 1,034 cases over a 17-year period, the clinical aspects of deep neck infections were analysed. The study underscored the critical importance of early detection and timely surgical intervention to prevent severe complications, including sepsis and respiratory failure. The authors identified common causes of these infections, such as dental issues, neck trauma, and oropharyngeal infections, noting that complications were more frequent in patients with diabetes or those who delayed seeking medical care.

Similarly, S. Priyamvada and G. Motwani investigated deep neck infections within an Indian population, identifying various forms of infection, including peritonsillar abscesses and phlegmons, which were often secondary to diseases of the throat and oral cavity [29]. Both studies emphasised the necessity of a multidisciplinary approach to treatment, incorporating surgical drainage, antibiotic therapy, and respiratory support, to reduce mortality rates.

A.G. Hassanein et al. conducted a retrospective study examining the prognosis of odontogenic mediastinitis [30]. Their findings identified key factors influencing disease outcomes, including the timeliness of surgical intervention and the efficacy of antibiotic therapy. These insights contribute to refining treatment strategies for mediastinitis. Finally, R. Pucci et al. shared their experiences in managing odontogenic infections of the head and neck that can progress to mediastinitis [31]. The authors stressed the importance of early detection and treatment, while also evaluating the limitations of current methods and exploring potential improvements in treatment outcomes. Their findings are crucial for advancing clinical practice in this field.

In conclusion, the studies reviewed unequivocally highlight the critical role of a multidisciplinary approach in managing odontogenic infections and mediastinitis. Early diagnostic methods, including the use of biomarkers and modern surgical techniques, have been shown to significantly improve patient prognosis. Accurate assessment of infection severity and timely intervention remain pivotal factors for successful treatment outcomes. However, despite advancements in understanding the pathogenesis of these infections, further optimisation of treatment strategies is required, particularly to address the variability in clinical presentations. Continued research in this area will facilitate the development of more effective therapeutic approaches and contribute to reducing mortality rates among patients with these complex and challenging infections.

Materials and Methods

The study was conducted in the Department of Maxillofacial Surgery at the Osh Interstate United Clinical Hospital between 2023 and 2024. A total of 40 patients diagnosed with secondary purulent mediastinitis of odontogenic and tonsillogenic origin were examined and treated. Most patients sought medical attention within the first 72 hours of disease onset, reflecting a low rate of timely treatment at the outpatient stage. Among the patients, 29 (72.5%) had odontogenic infections, while 11 (27.5%) had tonsillogenic infections. In the odontogenic cases, mediastinitis resulted from infectious processes associated with damage

to the roots of teeth and periapical tissues. In the tonsillogenic cases, chronic inflammation of the palatine tonsils was the underlying cause. The patients represented various age groups: 11 individuals (27.5%) were aged 18 to 40 years, 23 individuals (57.5%) were aged 41 to 60 years, and 6 individuals (15%) were over 60 years old. The average age of the patients was 46 years, with a higher proportion of men (55%) compared to women (45%).

The study adhered to ethical standards as outlined by national and international regulations, including the European Commission Guidelines on Ethics and Data Protection. All participants provided written informed consent after being fully informed about the study's purpose, the assurance of anonymity, potential risks, and the use of their data.

A comprehensive examination of the patients included general blood and urine tests, biochemical evaluations of liver and kidney function, and an assessment of the overall condition of the body. The results revealed elevated levels of inflammatory markers, such as C-reactive protein (CRP) and leucocytosis, indicating an active infectious process. To assess the spread of the infection, chest radiography, CT of the neck and chest, and ultrasound of the soft tissues of the neck were performed. Chest X-rays were used to rule out pneumonia or other pulmonary pathologies, CT provided detailed imaging of tissue damage and facilitated precise surgical planning, and ultrasound helped identify purulent foci in the soft tissues. Bacteriological studies identified the presence of gram-positive bacteria, including *Streptococcus* spp. and *Staphylococcus aureus*, which are common pathogens associated with odontogenic and tonsillogenic mediastinitis.

Surgical treatment involved the incision and drainage of purulent-necrotic foci. The procedures were performed under general intubation anaesthesia with meticulous antiseptic measures. A "P"-shaped incision was employed, granting access to the paratracheal and paratonsillar regions as well as the upper mediastinum. This approach enabled effective evacuation of pus and necrotic tissues. Flowing irrigation with antiseptic solutions – such as hydrogen peroxide, chlorhexidine, and Furacilin – was carried out 2-3 times daily to cleanse the cavities. To ensure adequate drainage, two drainage tubes with a diameter of 24 mm were inserted, facilitating the removal of pus from the mediastinum and neck. Postoperative care included the application of "Levomekol" ointment for wound management and aseptic dressings with a hypertonic solution to reduce oedema. Regular monitoring of inflammatory blood markers allowed for adjustments to antibiotic therapy when necessary. The control group consisted of 20 patients who received alternative treatments, including traditional antibiotic therapy and drainage without surgical intervention or minimally invasive methods.

This comparison enabled an evaluation of different approaches, highlighting the advantages and disadvantages of the surgical technique employed, and facilitated the identification of optimal treatment strategies for patients with mediastinitis.

Results

The study, conducted between 2023 and 2024 in the Department of Maxillofacial Surgery at the Osh Interstate United Clinical Hospital, aimed to evaluate the effectiveness of surgical treatment for secondary purulent mediastinitis of odontogenic and tonsillogenic origin and to compare its outcomes with alternative treatment methods. All patients underwent a standard set of diagnostic procedures, including general blood and urine tests, biochemical assessments of liver and kidney function, and measurements of inflammatory markers such as CRP and leukocyte levels, which indicated active infectious processes. Bacteriological studies identified gram-positive bacteria, including *Streptococcus* spp. and *Staphylococcus aureus*, confirming the infectious nature of mediastinitis, particularly in cases originating from odontogenic and tonsillogenic infections.

Various diagnostic methods were employed to determine the extent of infection spread. Chest radiography was used to rule out pneumonia and other pulmonary pathologies. CT of the neck and chest provided detailed imaging of mediastinal involvement, enabling precise surgical planning. Ultrasound of the neck's soft tissues was used to detect purulent foci, playing a crucial role in shaping further treatment strategies.

Patients in the main group underwent surgical treatment, which involved the dissection of purulent-necrotic foci, drainage of pus, and removal of necrotic tissues. The operations were performed under general intubation anaesthesia with meticulous antiseptic precautions. A "P"-shaped incision was employed to access the paratracheal and paratonsillar areas, facilitating effective evacuation of pus and necrotic tissues from the upper mediastinum and surrounding soft tissues. Following the removal of pus and necrotic material, the cavities were thoroughly irrigated with antiseptic solutions, including hydrogen peroxide, chlorhexidine, and Furacilin. To ensure effective drainage, two 24 mm diameter drainage tubes were inserted, enabling the removal of pus and preventing fluid accumulation.

Postoperative care included antibiotic therapy, along with wound treatment using "Levomekol" ointment and hypertonic dressings to minimise oedema. Regular monitoring of inflammatory blood markers was conducted, allowing for necessary adjustments in treatment

and antibiotic regimens. All patients in the main group exhibited a consistent reduction in inflammatory markers and showed a rapid improvement in their overall condition.

The control group, comprising 20 patients, was treated without surgery, relying solely on antibiotic therapy and drainage without major dissection. These patients experienced a higher rate of complications, including recurrent abscess formation and delayed reduction in inflammatory marker levels. In several cases, additional drainage procedures were required because the infectious process was not fully resolved due to the absence of radical surgical intervention. Patients in the control group had significantly longer hospital stays and a higher rate of recurrent infections, necessitating repeated antibiotic administration.

A comparative analysis revealed that patients in the main group, who underwent surgical treatment, achieved significantly better outcomes. These included a faster reduction in inflammatory marker levels, a lower risk of complications, and shorter hospitalisation periods. The main group also exhibited a reduced need for repeated operations or drainage procedures, indicating the higher effectiveness of surgical intervention. Conversely, patients in the control group often required additional interventions, as conservative treatments alone were insufficient to fully resolve the infection.

Overall, the study results confirmed that timely surgical intervention is the most effective approach for managing secondary purulent mediastinitis. It significantly improves patient outcomes and reduces the risk of complications compared to the conservative methods employed in the control group. Patients who received surgical treatment demonstrated notably faster recovery. Their postoperative period was less complicated, with inflammatory markers such as CRP and leukocytes beginning to decrease as early as the 3 to 5 days after surgery. These patients also experienced earlier improvements in general condition and a more rapid normalisation of body temperature compared to the control group, whose treatment was limited to antibiotics and conservative methods.

A key aspect of the surgical intervention, which demonstrated its high effectiveness, was the use of flowing antiseptic solutions to irrigate the cavities. This technique successfully prevented the development of new purulent foci and ensured more efficient tissue cleansing. None of the patients in the main group experienced recurrent infections during the postoperative period. In contrast, 25% of patients in the control group experienced relapses of mediastinitis, necessitating additional drainage procedures and adjustments to antibiotic therapy.

One notable outcome of the study was the reduction in hospitalisation duration for patients in the main group. Those who underwent surgical treatment were typically discharged within 10-14 days after surgery, compared to an average hospital stay of 18-21 days in the control group. This finding underscores the effectiveness of early surgical intervention and highlights the importance of an individualised approach in managing severe infections such as secondary mediastinitis.

Equally significant was the reduction in the risk of severe complications, including sepsis, phlegmon, and multiorgan failure. Patients in the main group did not develop these complications following surgery, whereas such complications occurred in 10% of cases in the control group. This reduction in complication rates also translated into a lower risk of mortality, an essential consideration when treating patients with severe purulent processes extending to the mediastinum.

Postoperative care played a critical role in achieving positive outcomes. The use of antiseptic ointments, such as "Levomekol", alongside regular dressings with hypertonic solutions to reduce oedema and promote lymphatic drainage, facilitated the rapid healing of postoperative wounds. In the main group, none of the patients developed secondary infections, whereas in the control group, only 70% of patients successfully completed their treatment course without complications.

Additionally, the use of CT and ultrasound imaging in the postoperative period proved invaluable for real-time monitoring of treatment effectiveness, significantly aiding in the prevention of potential complications. In contrast, the control group relied primarily on radiography and traditional monitoring methods, which led to delayed detection of relapses and necessitated additional surgical interventions, ultimately prolonging the rehabilitation period.

Surgical treatment demonstrated clear superiority over conservative methods in managing secondary purulent mediastinitis. Patients in the main group exhibited significantly faster recovery times and shorter hospital stays. Moreover, these patients experienced a lower incidence of complications, such as abscesses, phlegmon, and sepsis.

However, it is important to emphasise that the effectiveness of treatment largely depends on the timing of medical intervention. Early stages of the infectious process, when surgical intervention can be performed safely, are critical for achieving optimal outcomes. Conversely, patients who sought medical help during later stages of the disease, when severe

complications had already developed, required not only surgical intervention but also longer rehabilitation periods and adjustments to antibiotic therapy.

Discussion

According to the study by M. Del Prado Venegas Pizarro et al. [21], 72% of mediastinitis cases in the studied cohort were attributed to odontogenic infections. This high percentage underscores the critical importance of addressing oral infections as a significant etiological factor, necessitating heightened attention to early diagnosis and treatment. The etiology of odontogenic mediastinitis is linked to deep oral cavity infections, such as periodontitis, phlegmon, and other inflammatory processes, which spread through the fascial spaces of the neck into the mediastinum. Clinical studies have highlighted that the anatomical structure of the neck facilitates the rapid dissemination of infection to the lower mediastinum, thereby contributing to the development of mediastinitis. Bacteriological analyses of patients with odontogenic mediastinitis frequently identified pathogens such as *Streptococcus* spp. and *Staphylococcus aureus*, which can enter the bloodstream and cause sepsis. In 72.5% of the cases examined, mediastinal involvement was directly linked to odontogenic infections. Additionally, the studies revealed a high level of systemic intoxication in these patients, which could lead to severe complications such as shock. Timely initiation of therapy, including systemic antibacterial treatment and surgical intervention, was critical for successful management. Comprehensive surgical treatment, involving access to the mediastinum and the drainage of purulent foci, significantly improved patient prognosis. Moreover, analysis of patient data demonstrated the effectiveness of early diagnosis, particularly when employing CT to detect deep foci of infection and guide treatment planning. The study's findings confirmed that a systemic and integrated approach to treatment substantially reduced the risk of complications and mortality.

The association between odontogenic mediastinitis and its complications has been well-documented in numerous clinical studies, including the work of S. Prabhu and E. Nirmalkumar [28], which emphasises the importance of timely drainage in reducing the infectious load and stabilising the general condition of patients. Researchers highlight that early access to the anterior and posterior mediastinum is a critical step in managing mediastinitis, as it facilitates the prompt removal of purulent-necrotic masses and enhances sanitation processes. This approach mitigates the toxic effects of infection, particularly systemic intoxication, which can lead to shock and other severe complications. Early surgical

intervention combined with adequate drainage reduces the systemic burden of infection, preventing further intoxication and the onset of systemic inflammatory responses. A crucial goal of this approach is the prevention of sepsis and other potentially fatal outcomes associated with incomplete tissue cleansing. Delays in treatment during the early stages of the disease can result in irreversible complications and increased mortality, making timely surgical intervention a decisive factor in improving the prognosis of odontogenic mediastinitis.

Another important consideration is tonsillogenic mediastinitis, identified in 28% of cases. In these patients, the infection spreads through the deep tissues of the neck into the posterior mediastinum, presenting additional treatment challenges. As noted by M. Del Prado Venegas Pizarro et al. [21], compared to odontogenic mediastinitis, tonsillogenic mediastinitis often has a more complex progression due to its involvement of additional anatomical structures, including the posterior mediastinal space. This complexity makes the infectious process more difficult to control and predisposes patients to complications such as airway obstruction, which can result in oxygen deficiency, and tissue necrosis, further complicating therapy and increasing the risk of fatal outcomes. For patients with tonsillogenic mediastinitis, it is critical to plan surgical access precisely and perform timely drainage of infected tissues. These measures help to prevent the progression of the infection and the development of severe complications, including necrotic tissue states. Patients with tonsillogenic mediastinitis often present with characteristic symptoms, such as oedema and airway obstruction, which necessitate intensive surgical strategies aimed at reducing the risk of complications and preserving essential physiological functions.

The surgical technique, specifically the modified “U”-shaped incision, provides significant access to both the anterior and posterior mediastinum, enabling effective removal of purulent-necrotic masses and drainage of infected spaces. This method ensures comprehensive access to critical anatomical structures, facilitating thorough cleansing of infectious foci. It offers a considerable advantage over alternative approaches by allowing intervention not only in the anterior mediastinum but also in the posterior space, where infections can spread most aggressively. Moreover, this technique minimises complications such as respiratory tract disorders and systemic intoxication, which are often associated with inadequate drainage. The importance of early surgical intervention and drainage is strongly supported by numerous studies, including the work of C. Ma et al. [19]. These studies emphasise that a multidisciplinary approach to managing deep neck infections complicated

by descending necrotic mediastinitis significantly reduces the infectious load and aids in the rapid restoration of body functions. Research findings highlight that early surgical intervention, including active drainage, markedly decreases systemic intoxication and prevents the further spread of infection. This approach reduces the risk of sepsis and improves the overall condition of patients. The clinical application of such methods not only leads to a reduction in the infectious load but also promotes much faster recovery of body functions. These outcomes are corroborated by positive results observed in patients with severe forms of mediastinitis following surgical treatment.

An important aspect of the study was the bacteriological analysis, which identified a mixed microflora characteristic of purulent mediastinitis, including both aerobic and anaerobic bacteria. These findings align with previous studies, such as the work of C.Y. Ho et al. [6], which also reported a similar bacterial composition in patients with severe infections leading to descending necrotic mediastinitis. The complexity of the bacterial flora underscores the need for an integrated approach to treatment. The effectiveness of antibacterial therapy was supported by bacteriological findings, which showed a significant reduction in colony-forming units (CFUs) in purulent discharge following the application of antiseptic lavage and proteolytic enzymes. A sharp decrease in CFU levels within the first days of treatment highlighted the efficacy of the drainage and sanitation methods employed. According to C.Y. Ho et al. [6], the success of such therapeutic strategies, when combined with a multidisciplinary approach, was demonstrated by a reduction in infectious load, stabilisation of the patient's condition, and a decreased risk of complications. The use of antiseptic agents and proteolytic enzymes led to significant improvements, as confirmed by bacteriological studies. These studies recorded a marked decline in bacterial colonies by the third day of treatment, reflecting the effectiveness of these methods in sanitising infectious foci and controlling the spread of infection.

Assessment of systemic inflammation through peripheral blood parameters, particularly leukocyte levels and the erythrocyte sedimentation rate (ESR), is a crucial tool for monitoring the progression of the inflammatory process. These indicators enable the evaluation of therapeutic effectiveness and provide predictive insights into treatment outcomes. This is supported by the study conducted by A.G. Hassanein et al. [30], which demonstrated that by the fifth day of treatment, leukocyte levels consistently decreased to within normal ranges. This finding serves as clear evidence of effective systemic inflammation control and successful suppression of the infectious process, allowing for a positive prognosis regarding

patient recovery. The study further highlighted that normalisation of leukocyte levels is a critical marker of progress in treating odontogenic mediastinitis, particularly in cases involving complications arising from the spread of infection to the mediastinum. Similar trends were observed in our patients, validating the effectiveness of the chosen treatment strategies. These results underscore the importance of therapeutic measures aimed at halting the inflammatory process and reducing the infectious load on the body. Research emphasises the necessity of a comprehensive approach to managing mediastinitis, which incorporates surgical intervention, effective antibacterial therapy, and active drainage of the affected areas. Surgical treatment plays a pivotal role, as the timely removal of purulent-necrotic masses and ensuring adequate access to the mediastinum significantly reduce the risk of infection spread and the development of severe complications.

Conclusions

The results of this study confirm the high effectiveness of surgical treatment for secondary purulent mediastinitis of odontogenic and tonsillo-genic origin when compared to alternative conservative treatment methods. Patients in the main group, who underwent surgical intervention, showed significantly faster improvement in their condition, with reductions in inflammatory markers and symptoms such as fever and pain. This was in contrast to patients in the control group, who received only antibiotic therapy and drainage without surgical intervention. The surgical approach, which involved the opening and drainage of purulent-necrotic foci, effectively eliminated the infectious process and prevented complications such as sepsis or phlegmon. In the main group, levels of CRP and leukocytes consistently decreased by the 3 to 5 days post-surgery, demonstrating the positive impact of surgical intervention. Conversely, the control group experienced higher rates of complications, including the re-formation of abscesses and a slower decline in inflammatory markers. Patients in the control group also required longer hospitalisation periods and often suffered recurrent infections, necessitating additional procedures and adjustments to antibiotic therapy.

Comparative analysis revealed that surgical intervention significantly reduced hospitalisation duration. Patients in the main group were discharged within 10-14 days post-surgery, while those in the control group required 18-21 days of hospitalisation. Furthermore, none of the patients in the main group required repeat operations, whereas 25% of patients in the control group needed additional interventions due to the limited efficacy of conservative treatment.

In conclusion, the findings of this study underscore that timely surgical intervention is the most effective method for treating secondary purulent mediastinitis. It facilitates faster recovery, reduces the risk of complications, and shortens hospital stays compared to conservative methods. Future research in this area should focus on improving diagnostic techniques and developing advanced approaches to the surgical management of mediastinitis.

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