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Poor Prognostic Indicators Associated with Increased Mortality in Deep Neck Abscesses

Derin Boyun Apselerinde Mortalitenin Artmasıyla İlişkili Kötü Prognostik Faktörler

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Abstract

Objective: We aimed to identify the poor prognostic factors contributing to increased mortality and morbidity in patients with deep neck abscesses and to develop a clinical guide to assist physicians in optimizing patient management.

Methods: A total of 295 patients who underwent surgical intervention for deep neck abscess formation were included in this retrospective analysis. The laboratory tests of all patients were analyzed. Contrast-enhanced neck and thoracic computed tomography were performed to assess the localization of the abscess within cervical spaces and to identify complications such as mediastinitis and laryngeal edema. In this study, we investigated the association between mortality and mediastinitis, tracheotomy status, with laboratory parameter elevations, microbiological cultures from abscess specimens, and the specific anatomical neck spaces involved.

Results: Among patients who developed mortality, statistically significant increases were observed in age (p=0.01), C-reactive protein (p<0.001), neutrophil count (p<0.001), neutrophil-to-lymphocyte ratio, (p<0.001), white blood cell count (p<0.001), and hospital stay (p=0.001). Conversely, lymphocyte levels were significantly lower (p<0.001). The highest incidence was observed in cases with infections affecting the submandibular, carotid, and parapharyngeal spaces (66.7%). In cases of mediastinitis with fatal outcomes, the most frequently isolated microorganism was *Bacteroides fragilis* (41.7%).

Conclusion: Elevated serologic findings, diabetes mellitus, involvement of multiple cervical anatomical spaces (particularly submandibular, carotid, and parapharyngeal regions), and the isolation of pathogens such as *Streptococcus constellatus* and *Bacteroides fragilis* from abscess cultures are significant negative prognostic factors associated with increased morbidity and mortality.

Keywords: Deep neck abscess, mortality, mediastinitis, tracheotomy

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Öz

Amaç: Bu çalışmada derin boyun apselerinde mortalite ve morbidite artışına katkıda bulunan kötü prognostik faktörleri belirlemeyi ve klinisyene yardımcı olacak klinik bir rehber geliştirmeyi amaçladık.

Yöntem: Derin boyun apsesi nedeniyle cerrahi müdahale geçiren toplam 295 hasta bu retrospektif çalışmaya dahil edildi. Tüm hastaların laboratuvar testleri analiz edildi. Kontrastlı boyun ve torasik bilgisayarlı tomografi, apsenin servikal boşluklardaki lokalizasyonunu değerlendirmek ve mediastinit ve laringeal ödem gibi komplikasyonları belirlemek için istendi. Bu çalışmada, enflamatuvar laboratuvar parametrelerinin yüksekliği, apse örneklerinden alınan mikrobiyolojik kültürler ve etkilenen spesifik anatomik boyun boşlukları ile mediastinit, trakeotomi ve mortalite arasındaki ilişki araştırıldı.

Bulgular: Mortalite ile sonuçlanan hastalarda yaş (p=0,01), C-reaktif protein (p<0,001), nötrofil sayısı (p<0,001), nötrofil-lenfosit oranı (p<0,001), beyaz kan hücre sayısı (p < 0,001) ve hastanede kalış süresinde (p=0,001) istatistiksel olarak anlamlı bir yükseklik gözlendi. Buna karşılık lenfosit düzeyleri bu hastalarda anlamlı şekilde düşüktü (p<0,001). En yüksek mortalite oranı, multipl submandibular, karotis ve parafaringeal boşlukların etkilendiği enfeksiyonlarda (%66,7) gözlendi. Mortalite ile sonuçlanan mediastinit hastalarında en sık izole edilen mikroorganizma *Bacteroides fragilis* (%41,7) idi.

Sonuç: Serolojik bulgulardaki yükseklik, diabetes mellitus, birden fazla servikal anatomik boşluğun (özellikle submandibular, karotis ve parafaringeal bölgeler) tutulumu, apse kültürlerinden *Streptococcus constellatus* ve *Bacteroides fragilis* gibi patojenlerin izole edilmesi artmış morbidite ve mortalite ile ilişkili önemli olumsuz prognostik faktörlerdir.

Anahtar Kelimeler: Derin boyun enfeksiyonu, mortalite, mediastinit, trakeotomi

Introduction

Deep neck infection (DNI) is a prevalent inflammatory pathology characterized by the rapid progression of cellulitis or abscess formation, involving the fascial planes of the neck and deep cervical spaces[1]. The anatomy of the neck is highly complex, with deep cervical spaces interconnected[2]. Most DNIs originate from pharyngeal sources (36-47%) or odontogenic infections (33-45%)[3]. These initially localized infections can rapidly spread to the parapharyngeal, carotid, prevertebral, and pretracheal spaces, due to the anatomical communication between cervical spaces. In severe cases, the infection may further extend into the mediastinum, leading to life-threatening complications[3]. Consequently, DNI can result in significant morbidity and mortality due to complications such as laryngeal edema and airway obstruction, mediastinitis, septic thrombophlebitis, pericarditis, pneumonia, pleural effusion, jugular vein thrombosis, septic shock, carotid artery rupture, causing massive hemorrhage, and disseminated intravascular coagulation[4].

The source of these infections, their patterns of spread, and the microbiological agents involved vary among patients. Therefore, effective treatment requires a comprehensive understanding of deep neck spaces, the microbiology of the infection, potential complications, and additional factors that may exacerbate DNI[5,6]. A complete blood count (CBC) is an essential and widely utilized laboratory test for patients presenting with DNI. It also serves as a cost-effective diagnostic tool. The serological biomarkers assessed in CBC provide significant insights into inflammatory activity during acute infections. in addition to these serological markers, the neutrophil-to-lymphocyte ratio (NLR), which can be derived from CBC results, is recognized as a reliable indicator of systemic inflammation[7]. During an infection, the body increases neutrophil and leukocyte production to combat pathogens while reducing lymphocyte production due to redistribution or suppression. Consequently, an elevated NLR may serve as a significant indicator of severe or serious infections, particularly in cases of deep neck abscesses[7,8]. C-reactive protein (CRP) is an acute-phase protein present in plasma and synthesized by hepatocytes. Due to its rapid increase and decrease in response to the inflammatory process, CRP serves as a more sensitive marker of inflammation compared to the white blood cell (WBC) count[9]. In this study, a retrospective analysis was conducted on 295 patients treated for deep neck abscesses in our clinic over the past fifteen years, categorized based on abscess location. Laboratory findings at the time of initial hospital admission were recorded. Various factors, including gender, age, mediastinitis, tracheotomy status due to laryngeal and neck edema, concomitant diabetes mellitus, mortality, and bacterial growth, were analyzed to identify key indicators in the management of DNI. In this study, we examined the relationship between mortality and morbidities, such as mediastinitis and tracheotomy status, and laboratory parameter elevations, bacterial cultures from abscess samples, and the anatomical neck spaces affected. Consequently, this study aimed to identify the poor prognostic factors contributing to increased mortality and morbidity in patients with deep neck abscesses and to develop a clinical guide to assist physicians in optimizing patient management.

Materials and Methods

A total of 295 patients who underwent surgical intervention for deep neck abscess formation at Dicle University Otorhinolaryngology Clinic between January 2020 and January 2025 were included in this retrospective analysis. The study was approved by the Local Institutional Ethics Committee of Dicle University (15.05.2024-94). The demographic data of all patients, including age, gender, address, detailed clinical history, general examination, otorhinolaryngology examination, systemic evaluation, and duration of hospitalization, were recorded. Laboratory tests, including WBC count, neutrophil count, lymphocyte count, NLR, platelet count, and CRP levels, measured at the time of initial hospital admission, were analyzed. Contrast-enhanced neck and thoracic computed tomography (CT) and/or ultrasonography scans were performed to assess the localization of the abscess within cervical spaces, and to identify complications such as mediastinitis and laryngeal edema. These patients underwent abscess drainage in the operating room using a transcervical and transoral approach. After abscess drainage, the abscess content was sent to microbiology for culture, and the microorganisms identified according to the microbiology results were recorded. Tracheotomy surgery was performed on patients with severe respiratory distress and laryngeal edema. Drainage was also performed in collaboration with the chest surgery clinic on patients who developed mediastinitis. The patients were then admitted to the clinic or intensive care unit. They were monitored in the intensive care unit by an anesthesiologist. Intravenous 1 g ceftriaxone twice daily and clindamycin 500 mg twice daily were started as antibiotic treatment at the time of admission. During the patient follow-up, antibiotic treatment was adjusted according to the abscess culture results and the response. Patients who underwent tracheotomy due to laryngeal edema during abscess drainage and those who experienced mortality during the postoperative follow-up period were documented. Patients diagnosed with tuberculosis, those with abscesses resulting from foreign bodies, trauma, or malignancies, patients with cellulitis leading to deep neck infection, or those whose abscesses were drained using fine-needle aspiration, were excluded from the study. In conclusion, this study investigated the association of mortality and morbidity, including mediastinitis and tracheotomy status, with laboratory parameter elevations, microbiological cultures from abscess specimens, and the specific anatomical neck spaces involved. Our objective is to provide clinicians with valuable prognostic markers to assess mortality and morbidity in patients presenting with DNI.

Statistical Analysis

Quantitative variables were expressed using measures of central tendency and dispersion: mean ± standard deviation. The chi-square test was employed to assess differences between proportions and relationships between categorical variables. To evaluate differences in group means, the Mann-Whitney U test was applied in cases where the assumptions of normality and homogeneity of variance were not met. The correlation between two numerical variables was analyzed using Spearman's rank correlation test, a non-parametric method, as the data did not follow a normal distribution. Statistical significance was set at p=0.05 for all analyses. Statistical computations were performed using IBM SPSS (Statistical Package for the Social Sciences for Windows, Version 21.0, Armonk, NY, IBM Corp.).

Results

The study population comprised 148 males (50.2%) and 147 females (49.8%). The age range for male patients was 0 to 77 years, with a mean age of 31.13±19.0 years, while the age range for female patients was 0 to 86 years, with a mean age of 29.09±18.82 years. Mediastinitis developed in 24 patients (8.1%), while tracheotomy was performed in 46 patients (15.6%) due to laryngeal edema and respiratory distress. Mortality occurred in 12 patients (4.1%) with mediastinitis during postoperative follow-up, primarily due to septic shock, electrolyte imbalances, and cardiovascular or cerebrovascular complications. Diabetes mellitus was present in 13 patients (4.4%), whereas it was absent in the

Table 1. Mortality and morbidity rates in deep neck infections

Parameter	Group	n (%)
Gender	Female	147 (49.8%)
	Male	148 (50.2%)
Mediastinitis	Present	24 (8.1%)
	Absent	271 (91.9%)
Mortality	Present	12 (4.1%)
	Absent	283 (95.9%)
Tracheotomy	Performed	46 (15.6%)
	Not performed	249 (84.4%)
Diabetes mellitus	Present	13 (4.4%)
	Absent	282 (95.6%)

remaining 282 patients (95.6%) (Table 1).

Among patients who developed mediastinitis, the mean neutrophil count was 17.4±6.53×10^9/L, the mean lymphocyte count was 1.39±0.94×10^9/L, and the mean NLR was 19.13±10.05. The mean CRP level was 287.92±69.3 mg/L, the mean platelet count was 305.63±114.76×10^9/L, and the mean WBC count was 20.34±6.72×10^9/L. The average duration of hospitalization was 18.58±8.8 days. Statistically significant increases were observed in age (p=0.006), CRP (p<0.001), neutrophil count (p<0.001), NLR (p<0.001), and WBC count (p<0.001), with a mean patient age of 40.88±19.57 years. The length of hospital stay was also significantly longer (p<0.001). Conversely, lymphocyte levels were significantly lower (p<0.001). However, no significant difference was found in platelet counts (p=0.438) (Table 2).

Among patients who died, the mean neutrophil count was 19.98±8.02×10^9/L, the mean lymphocyte count was 1.04±0.52×10^9/L, and the mean NLR was 23.78±8.55. The mean CRP level was 294.25±86.03 mg/L, the mean platelet count was 267.0±130.29×10^9/L, and the mean WBC count was 22.83±8.54×10^9/L. The mean age of these patients was 44.92±20.64 years, and the mean duration of hospitalization was 18.33±12.15 days. Statistically significant increases were observed in age (p=0.01), CRP (p<0.001), neutrophil count (p<0.001), NLR (p<0.001), WBC count (p<0.001), and hospital stay (p=0.001). Conversely, lymphocyte levels were significantly lower (p<0.001). However, no significant difference was found in platelet counts (p=0.092) (Table 2).

In patients who underwent tracheotomy, the mean neutrophil count was 15.94±5.84×10^9/L, the mean lymphocyte count was 1.42±0.83×10^9/L, and the mean NLR was 15.92±9.21. The mean CRP level was 257.41±78.11 mg/L, the mean platelet count was 292.39±98.45×10^9/L, and the mean WBC count was 18.82±6.07×10^9/L. The mean age of this patient group was 39.52±18.51 years, and the mean duration of hospitalization was 16.09±7.23 days. Statistical analysis revealed significantly higher values for age (p<0.001), CRP (p<0.001), neutrophil count (p<0.001), NLR (p<0.001), WBC count (p<0.001), and hospital stay (p<0.001). In contrast, lymphocyte (p<0.001) and platelet (p=0.029) levels were significantly lower (Table 2). The association of inflammatory parameters with mortality, mediastinitis, and tracheotomy is shown in Figure 1. Mediastinitis developed in 6 out of 13 patients with diabetes mellitus (25%), tracheotomy was performed in 8 patients (17%), and 4 patients (33%) succumbed to the disease (Table 2).

The distribution of infection across various cervical spaces, as assessed following contrast-enhanced neck and thoracic CT, is presented in Table 3. The most commonly affected region was the submandibular space (24.1%), followed by the peritonsillar (14.6%) and parotid (8.1%) regions. Additionally, multiple space involvement, including the submandibular, carotid, and parapharyngeal spaces (6.8%), as well as isolated parapharyngeal involvement (5.4%), was observed.

Table 2. The association of inflammatory parameters and hospital stay with mortality, mediastinitis, and tracheotomy

	Mediastinitis			**Tracheotomy**			**Mortality**		
	Present (n=24)	**Absent (n=271)**	**p-value**	**Present (n=46)**	**Absent (n=249)**	**p-value**	**Present (n=12)**	**Absent (n=283)**	**p-value**
CRP	292	103	**<0.001**	256.5	92	**<0.001**	307.5	107	**<0.001**
Lymphocyte	1.25	2	**<0.001**	1.3	2	**<0.001**	0.9	2	**<0.001**
Neutrophil	16.1	10.9	**<0.001**	15.1	10.6	**<0.001**	17.75	11	**<0.001**
NLR	17.25	5.3	**<0.001**	14	5.1	**<0.001**	25.15	5.5	**<0.001**
Platelet	294	312	0.438	294	318	**0.029**	259	312	0.092
WBC	18.9	14.6	**<0.001**	17.75	14.5	**<0.001**	19.75	14.8	**<0.001**
Age	37.5	28	**0.006**	34	27	**<0.001**	45.5	28	**0.01**
Duration of hospitalization	17.5	7	**<0.001**	15	7	**<0.001**	15.5	7	**0.001**
Diabetes mellitus	6 (25%)	7 (3%)	**<0.001**	8 (17%)	5 (2%)	**<0.001**	4 (33%)	9 (3%)	**<0.001**

Mann-Whitney U test, n (%) – Fisher's exact test, CRP: C-reactive protein, NLR: Neutrophil-to-lymphocyte ratio, WBC: White blood cell

Among the 24 patients who developed mediastinitis, the infection commonly involved multiple anatomical regions. The highest incidence was observed in cases with infections affecting the submandibular, carotid, and parapharyngeal spaces (66.7%). The second most frequent pattern of involvement included infections spanning the submandibular, submental, and carotid spaces (12.5%), while the third most common presentation was associated with infections localized in the retropharyngeal space (8.3%) (Table 4).

During the follow-up period, 10 patients who developed mediastinitis died. Among these patients, abscess formation was most frequently identified in multiple submandibular, carotid, and parapharyngeal regions, with an incidence of 83.3%. The second most common site of abscess formation among mortal cases was the retropharyngeal region, accounting for 16.7% of cases (Table 4).

Among the 46 patients who underwent tracheotomy, the most

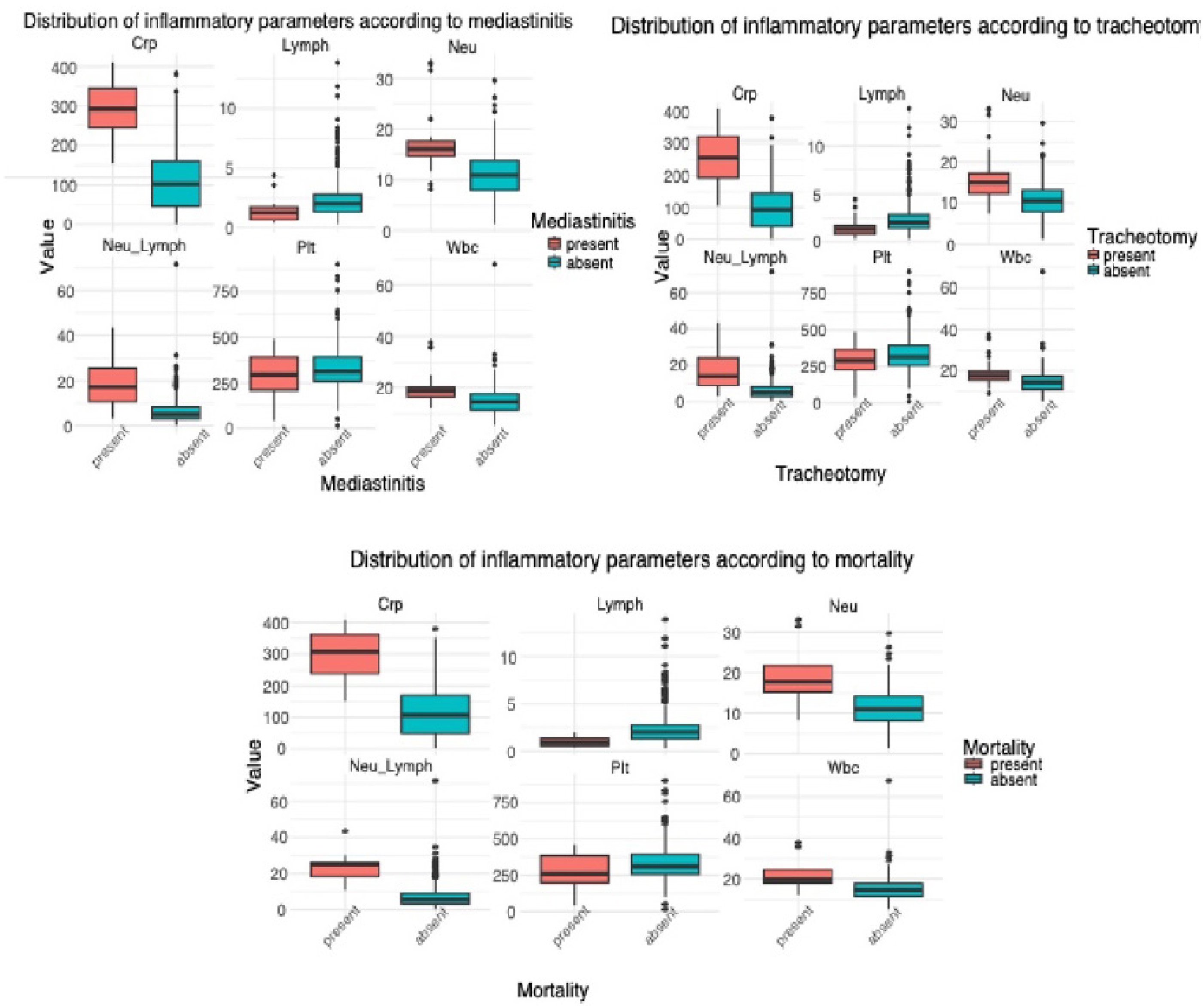

Figure 1. Association of inflammatory parameters with mortality, mediastinitis, and tracheotomy

frequently observed infection involved the submandibular, carotid, and parapharyngeal regions, occurring in 43.5% of cases. The second most common infection pattern was identified in the multiple submandibular, submental, and parapharyngeal regions, with an incidence of 17.4%. The distribution of infections across other cervical spaces in patients with tracheotomy is detailed in Table 4.

Table 3. Cervical spaces affected in deep neck infections

Affected cervical spaces	n (%)
Submandibular	71 (24.1%)
Peritonsillar	43 (14.6%)
Parotid	24 (8.1%)
Submandibular, carotid, parapharyngeal	20 (6.8%)
Parapharyngeal	16 (5.4%)
Retromandibular	12 (4.1%)
Submandibular, submental	10 (3.4%)
Retromandibular, masticator	9 (3.1%)
Submandibular, parapharyngeal	9 (3.1%)
Submental	9 (3.1%)
Submandibular, submental, parapharyngeal	8 (2.7%)
Masticator	7 (2.4%)
Paratracheal	7 (2.4%)
Retropharyngeal	6 (2.0%)
Posterior cervical	5 (1.7%)
Submandibular, submental, carotid	5 (1.7%)
Submandibular, parotid	4 (1.4%)
Submandibular, retromandibular	4 (1.4%)
Peritonsillar, parapharyngeal	3 (1.0%)
Submandibular, submental, paratracheal	3 (1.0%)
Submental, sublingual	3 (1.0%)
Buccal	2 (0.7%)
Parapharyngeal, masticator	2 (0.7%)
Submandibular, buccal	2 (0.7%)
Submandibular, masticator	2 (0.7%)
Submandibular, submental, parapharyngeal, paratracheal	2 (0.7%)
Carotid, parapharyngeal	2 (0.7%)
Parotid, parapharyngeal	1 (0.3%)
Peritonsillar, submandibular, parapharyngeal	1 (0.3%)
Peritonsillar, submandibular, submental, parapharyngeal	1 (0.3%)
Retromandibular, buccal	1 (0.3%)
Submandibular, carotid	1 (0.3%)
Submandibular, submental, sublingual	1 (0.3%)

Bacterial analysis was conducted on abscess samples aspirated from 295 patients during surgery, followed by culture and sensitivity testing for all specimens. After a 48-hour incubation period, microbial growth was observed in all cases. The most frequently identified microorganism was *Streptococcus constellatus* (27.1%), followed by *Streptococcus anginosus* (21.4%) and *Staphylococcus aureus* (13.6%). Other isolated organisms included Gram-positive cocci (6.1%), *Streptococcus pyogenes* (5.1%), *Fusobacterium nucleatum* (4.4%), *Streptococcus viridans* (3.1%), and *Bacteroides fragilis* (2.4%). Additional microorganisms, as detailed in Table 5, were detected in smaller proportions.

In abscess cultures obtained from patients who developed mediastinitis, the most frequently isolated microorganism was *Streptococcus constellatus*, accounting for 45.8% of cases. This was followed, in descending order of prevalence, by *Bacteroides fragilis* (20.8%), *Streptococcus anginosus* (12.5%), *Staphylococcus aureus* (12.5%), *Fusobacterium necrophorum* (4.2%), and *Peptostreptococcus* (4.2%). In cases of mediastinitis with fatal outcomes, the most frequently isolated microorganism was *Bacteroides fragilis* (41.7%), followed by *Streptococcus constellatus* (33.3%), *Streptococcus anginosus* (16.7%), and *Staphylococcus aureus* (8.3%) (Table 6).

In patients who underwent tracheotomy, the most frequently isolated microorganism from abscess cultures was *Streptococcus constellatus* (32.6%), followed by *Streptococcus anginosus* (17.4%). *Bacteroides fragilis* (15.2%) and *Staphylococcus aureus* (15.2%) ranked third in frequency, with other microorganisms listed in descending order of prevalence in Table 6.

Affected cervical spaces and bacterial analysis in patients with tracheotomy status, mediastinitis, and mortality are shown in Figures 2-4.

Discussion

DNI represent a significant cause of morbidity and mortality, particularly in developing countries. Despite advancements in early antibiotic intervention and contemporary preventive and therapeutic strategies for dental diseases, these infections—which commonly originate from odontogenic or pharyngeal sources—remain prevalent worldwide[6]. In this study, a retrospective analysis was conducted on 295 patients, diagnosed with deep neck abscesses to evaluate the inflammatory serological biomarkers, including WBC count, neutrophil count, lymphocyte count, NLR, platelet

Table 4. The relationship between multiple neck space involvement and mortality, mediastinitis, and tracheotomy

Mediastinitis		**Tracheotomy**		**Mortality**	
Multiple neck space	(n=24)	Multiple neck space	(n=46)	Multiple neck space	(n=12)
Submandibular, carotid, parapharyngeal	16 (66.7%)	Submandibular, carotid, parapharyngeal	20 (43.5%)	Submandibular, carotid, parapharyngeal	10 (83.3%)
Submandibular, submental, carotid	3 (12.5%)	Submandibular, submental, parapharyngeal	8 (17.4%)	Retropharyngeal	2 (16.7%)
Retropharyngeal	2 (8.3%)	Submandibular, submental, carotid	5 (10.8%)		
Submandibular, submental, Parapharyngeal, paratracheal	2 (8.3%)	Submandibular, submental, paratracheal	3 (6.5%)		
Carotid, parapharyngeal	1 (4.2%)	Retropharyngeal	2 (4.3%)		
		Submandibular, submental, parapharyngeal, paratracheal	2 (4.3%)		
		Carotid, parapharyngeal	1 (2.2%)		
		Peritonsillar, submandibular, parapharyngeal	1 (2.2%)		
		Peritonsillar, submandibular, submental, parapharyngeal	1 (2.2%)		
		Submandibular, retromandibular	1 (2.2%)		
		Submandibular, submental, sublingual	1 (2.2%)		
		Submental, sublingual	1 (2.2%)		

count, and CRP levels, in relation to mortality, mediastinitis, and tracheotomy. The findings revealed that CRP, neutrophil count, WBC count, and NLR values were significantly elevated in patients who experienced mortality or morbidity, such as mediastinitis and tracheotomy, whereas the lymphocyte ratio was significantly reduced. A review of the literature indicates the presence of numerous studies investigating inflammatory parameters in DNI[6,10,11]. In their study, Koç et al.[12] reported that in patients with a hospitalization period exceeding 7 days, neutrophil count, CRP levels, NLR, and WBC count were elevated, while lymphocyte levels were decreased. Consequently, they identified age, CRP levels, and NLR as significant factors influencing morbidity. Similarly, Dogruel et al.[13] examined the relationship between NLR and hospitalization duration, concluding that patients with an NLR value greater than 5.6 experienced prolonged hospitalization and increased antibiotic requirements. Ghasemi et al.[14] identified a positive correlation between the NLR and hospitalization duration in their study. Gallagher et al.[15] reported that patients with elevated CRP and NLR

Table 5. Bacterial microorganisms identified in cultures from all patients

Bacterial analiysis	n=295
Streptococcus constellatus	80 (27.1%)
Streptococcus anginosus	63 (21.4%)
Staphylococcus aureus	40 (13.6%)
Gram-pozitive cocci	18 (6.1%)
Streptococcus pyogenes	15 (5.1%)
Fusobacterium nucleatum	13 (4.4%)
Streptococcus viridans	9 (3.1%)
Bacteroides fragilis	7 (2.4%)
Parvimonas micra	6 (2%)
Streptococcus oralis	5 (1.7%)
Streptococcus pneumoniae	5 (1.7%)
Actinomyces odontolyticus	3 (1.0%)
Fusobacterium necrophorum	3 (1.0%)
Prevotella denticola	3 (1.0%)
Prevotella intermedia	3 (1.0%)
Peptostreptococcus	2 (0.7%)
Streptococcus intermedius	2 (0.7%
Atopobium parvulum	1 (0.3%)
Bacillus licheniformis	1 (0.3%)
Eggerthia catenaformis	1 (0.3%)
Enterobacter aerogenes	1 (0.3%)
Finegoldia magna	1 (0.3%)
Fusobacterium nucleatus	1 (0.3%)
Gemella morbillorum	1 (0.3%)
Gram-negative cocci	1 (0.3%)
Haemophilus aphrophilus	1 (0.3%)
Klebsiella pneumoniae	1 (0.3%)
Prevotella buccae	1 (0.3%)
Prevotella loescheii	1 (0.3%)
Proteus mirabilis	1 (0.3%)
Serratia marcescens	1 (0.3%)
Staphylococcus carnosus	1 (0.3%)
Streptococcus agalactiae	1 (0.3%)
Streptococcus parasanguinis	1 (0.3%)
Veilonella atypica	1 (0.3%)

levels had prolonged hospital stays and suggested that the NLR could serve as a prognostic marker for DNI. Conversely, Mirochnik et al.[9] concluded that CRP concentration was not a prognostic factor for the spread of DNI in their study. Our analysis revealed that CRP, NLR, neutrophil count, and WBC levels were significantly elevated, while the lymphocyte ratio was lower in patients with deep neck abscesses; consistent with findings reported in the majority of the literature. These alterations were associated with increased mortality and morbidity. Furthermore, we observed that patients with these elevated inflammatory markers experienced prolonged hospital stays. Based on these findings, we suggest that these serological biomarkers may serve as important prognostic indicators in patients presenting with deep neck abscesses.

O'Brien et al.[16] reported that age and diabetes are significant factors influencing morbidity and mortality in patients with DNI. Similarly, Gehrke et al.[3] concluded that diabetes contributes to increased morbidity and mortality in these infections. Consistent with these findings, our study also identified advanced age and diabetes as key predisposing factors, particularly for mortality and morbidity.

Numerous studies have reported that the submandibular region is the most frequently affected site in deep neck abscesses[17,18]. Similarly, Das et al.[19] identified the submandibular region as the most commonly involved site, followed by the sublingual region, while the carotid space was among the least frequently affected areas. Furthermore, Suehara et al.[10] reported that the submandibular region is the most commonly involved site, with multiple submandibular and parapharyngeal regions being the second most frequently affected areas. Gehrke et al.[3] reported that abscess formation most frequently occurred in the carotid space, followed by the submandibular space. In our study, we found that abscess formation was most commonly observed in the submandibular region, followed by the peritonsillar region. However, mortality, mediastinitis, and the need for tracheotomy were most frequently observed in patients with multiple submandibular, parapharyngeal, and carotid region involvements. Additionally, while the retropharyngeal space was the second most common site associated with mortality, multiple submandibular, submental, and carotid region involvement were the second most frequent sites associated with mediastinitis.

The microbiology of deep neck abscesses is generally similar, as these infections typically originate from oropharyngeal, (peritonsillar and parapharyngeal) or nasopharyngeal flora[20]. A diverse range of aerobic, microaerophilic, and anaerobic pathogens contribute to the infection, with microbiological patterns varying based on geographical differences[21]. In deep neck abscesses, α-*hemolytic Streptococcus*, *Enterococcus*, and *Klebsiella* species are commonly identified as aerobic

Table 6. Bacterial analysis in patients with mortality and morbidity					
Mediastinitis		**Tracheotomy**		**Mortality**	
Bacterial analysis	**(n=24)**	**Bacterial analysis**	**(n=46)**	**Bacterial analysis**	**(n=12)**
Streptococcus constellatus	11 (45.8%)	*Streptococcus constellatus*	15 (32.6%)	*Bacteroides fragilis*	5 (41.7%)
Bacteroides fragilis	5 (20.8%)	*Streptococcus anginosus*	8 (17.4%)	*Streptococcus constellatus*	4 (33.3%)
Streptococcus anginosus	3 (12.5%)	*Bacteroides fragilis*	7 (15.2%)	*Streptococcus anginosus*	2 (16.7%)
Staphylococcus aureus	3 (12.5%)	*Staphylococcus aureus*	7 (15.2%)	*Staphylococcus aureus*	1 (8.3%)
Fusobacterium necrophorum	1 (4.2%)	*Gram-pozitive cocci*	2 (4.3%)		
Peptostreptococcus	1 (4.2%)	*Actinomyces odontolyticus*	1 (2.2%)		
		Eggerthia catenaformis	1 (2.2%)		
		Fusobacterium necrophorum	1 (2.2%)		
		Parvimonas micra	1 (2.2%)		
		Peptostreptococcus	1 (2.2%)		
		Streptococcus pyogenes	1 (2.2%)		
		Streptococcus viridans	1 (2.2%)		

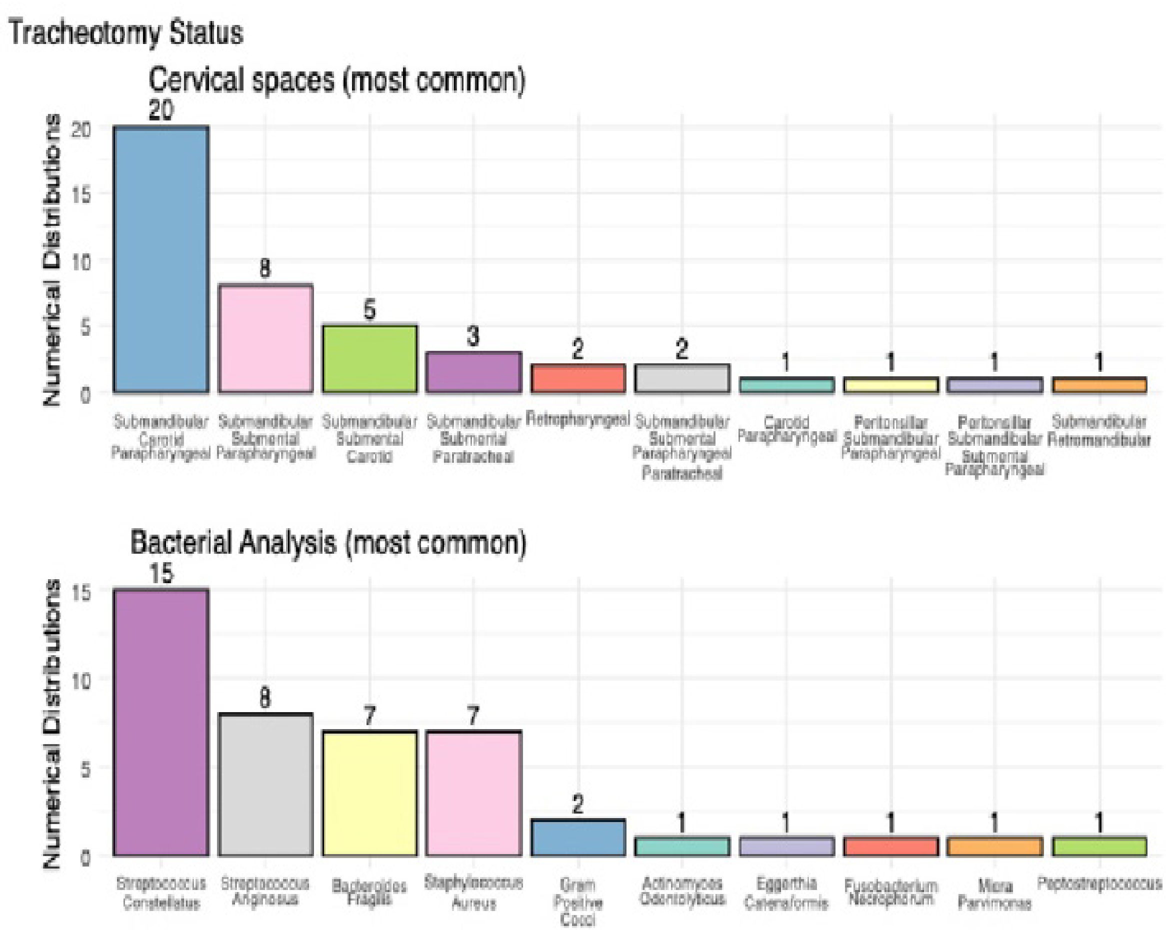

Figure 2. Affected cervical spaces and bacterial asnalysis in patients with tracheotomy status

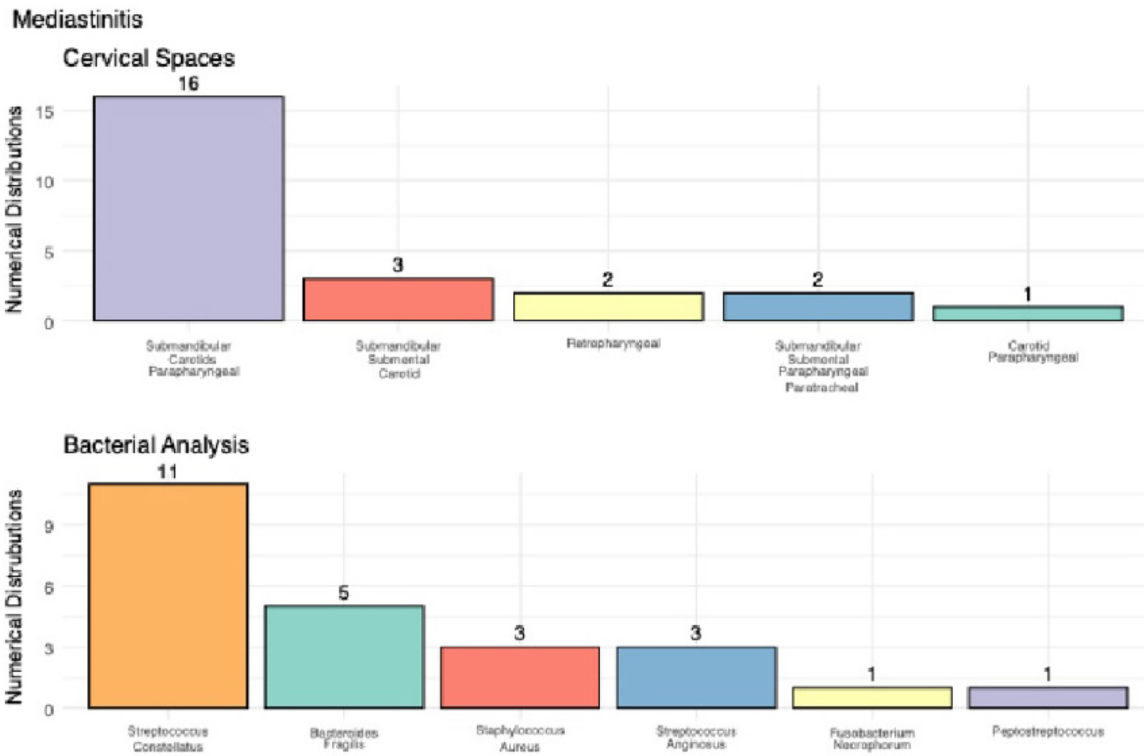

Figure 3. Affected cervical spaces and bacterial analysis in patients with mediastinitis

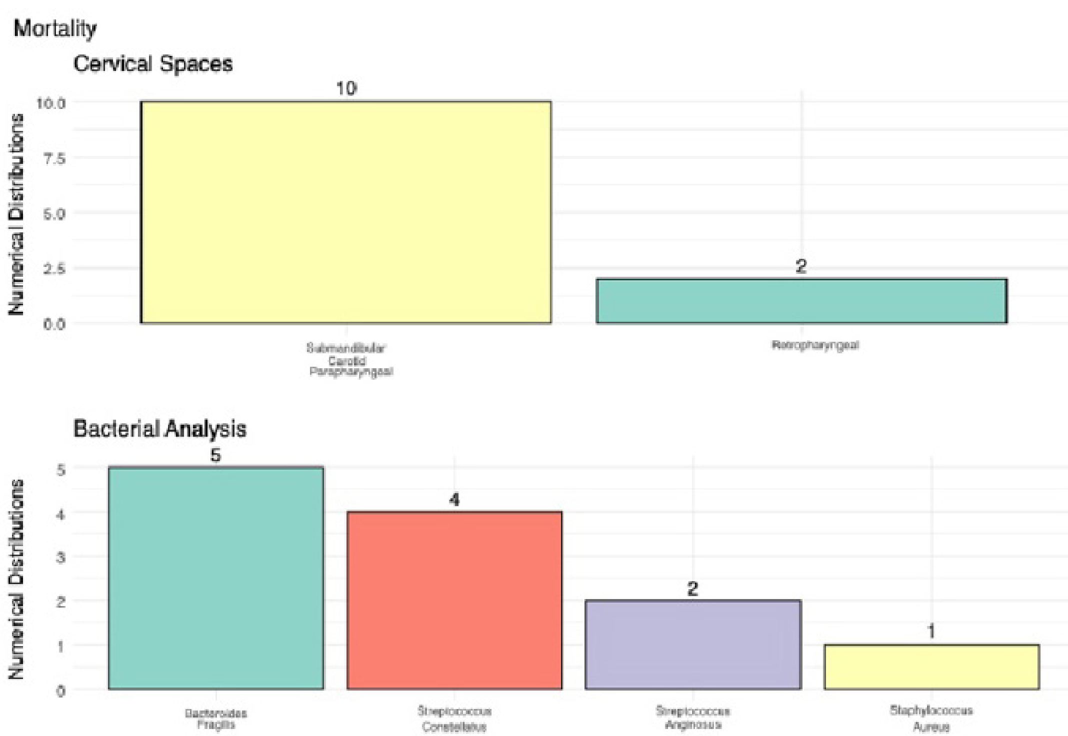

Figure 4. Affected cervical spaces and bacterial analysis in patients with mortality

pathogens, while *Peptostreptococcus* and *Bacteroides* species are frequently observed as anaerobic bacteria[22]. Singhal et al.[23] reported that *Staphylococcus aureus* was the most frequently isolated organism in both pediatric and adult populations. In contrast, Mathew et al.[24] found that *Streptococcus pyogenes* was the predominant pathogen, followed in frequency by *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Rijal et al. reported that *Klebsiella pneumoniae* was the most frequently isolated organism, followed by *Streptococcus anginosus*, *Staphylococcus aureus*, and *Streptococcus constellatus* in decreasing order of frequency. In our study, *Streptococcus constellatus* was identified as the predominant pathogen, with *Streptococcus anginosus*, *Staphylococcus aureus*, and Gram-positive cocci following in order of frequency. Similarly, Hu et al.[25] observed frequent isolation of *Streptococcus constellatus*, *Streptococcus anginosus*, *Peptostreptococcus micros*, and *Prevotella buccae* in patients diagnosed with mediastinitis. In our study, the most frequently isolated pathogens in patients who developed mediastinitis were *Streptococcus constellatus*, *Bacteroides fragilis*, and *Streptococcus anginosus*. Among patients who died, however, *Bacteroides fragilis* was the predominant organism, followed by *Streptococcus constellatus* and *Streptococcus anginosus*. Additionally, in patients who experienced respiratory distress and required tracheotomy, the organisms isolated most frequently were *Streptococcus constellatus*, *Streptococcus anginosus*, *Bacteroides fragilis*, and *Staphylococcus aureus*, in descending order of frequency.

Based on the findings of our study, we emphasize that elevated serological markers—including WBC count, NLR, CRP levels, and neutrophil percentage, coupled with reduced lymphocyte percentage—as well as the presence of diabetes mellitus, involvement of multiple cervical anatomical spaces (particularly submandibular, carotid, and parapharyngeal regions), and isolation of pathogens such as *Streptococcus constellatus* and *Bacteroides fragilis* from abscess cultures, are associated with higher rates of mortality and mediastinitis. Additionally, these patients may require tracheotomy more frequently due to respiratory distress.

Study Limitations

The limitations of this study should be acknowledged. Firstly, the study was retrospective in design and conducted at a single center, potentially limiting the generalizability of the findings. Future research should aim to validate these results through prospective studies involving larger, multicenter cohorts.

Conclusion

The management of deep neck abscesses requires a multidisciplinary approach. Our findings indicate that elevated WBC counts, NLR, CRP levels, increased neutrophil percentages, decreased lymphocyte percentages, comorbidities such as diabetes mellitus, involvement of multiple cervical anatomical spaces (particularly submandibular, carotid, and parapharyngeal regions), and the isolation of pathogens such as *Streptococcus constellatus* and *Bacteroides fragilis* from abscess cultures, are significant negative prognostic factors associated with increased morbidity and mortality. We suggest that clinicians and surgeons who recognize these prognostic indicators and initiate timely and comprehensive medical treatment may substantially reduce patient mortality rates.

Ethics

Ethics Committee Approval: The study was approved by the Local Institutional Ethics Committee of Dicle University (15.05.2024-94).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: S.C., M.A., Concept: S.C., G.K., Design: S.C., M.E.E., Data Collection or Processing: S.C., S.B., Analysis or Interpretation: S.C., M.Ak., Literature Search: S.C., M.E.E., Writing: S.C., M.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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