



OVERVIEW OF FACTORS ASSOCIATED WITH DEEP NECK ABSCESS AT HASAN SADIKIN HOSPITAL BANDUNG

Ilman Fathony Martanegara^{1}, Sinta Sari Ratunanda¹, Ongka Muhammad Saifuddin¹, Wijana¹, Ratna Anggraeni Agustian¹, Dindy Samiadi¹*

¹Department of Otorhinolaryngology - Head and Neck Surgery, Faculty of Medicine Padjadjaran University / Hasan Sadikin General Hospital Bandung, Indonesia

ABSTRACT

BACKGROUND: The neck abscess is influenced many factors such as age, sex, socioeconomic, neck space, origin infection, and comorbid. **OBJECTIVE:** To determine the overview of factor that successfully affect treatment of the deep neck abscess in the period January 2015 to December 2019 at ENT Head and Neck Surgery KSM Dr. Hasan Sadikin Hospital Bandung. **METHODS:** Descriptive observational study at ENT Head and Neck Surgery ward Dr. Hasan Sadikin Hospital Bandung on medical records of patients with the deep neck abscess. The data collected was descriptively in terms of numbers and percentages for categorical data and presented in tables. **RESULTS:** A total of 113 cases of deep neck abscess with mortality percentage 12.4%, the highest age range is 20-60 years 77%, male is the mostly case 58.4%, worker group 76.1%, living in rural area 63.7%, involving multispace abscess get 54%, the most common cause is dental infection 55.8%, most cultures bacteria are anaerob 33.6%. Diabetes Mellitus with HbA1c level above 7% is the highest comorbid diseases get (19.5%) and hypertension grade 1 and acute kidney Injury grade 1 is the most mortality comorbid get 50%. The related factor about deep neck abscess are rural living area, men, and history of dental infection **CONCLUSION:** Study subject that most affected deep neck abscess is adult, male, worker, rural living area, multispace abscess, dental infection, Rural living area, anaerob bacteria, Diabetes Mellitus. The biggest mortality is elderly, female, worker, rural living area, parotis abscess, parotitis, no growth culture, comorbid hypertension an acute kidney injury stage 1.

Keywords: Deep neck abscess, related factor, infection, comorbidities, anaerobic bacteria

INTRODUCTION

The condition known as deep neck abscess poses a significant risk in the field of ENT (Ear, Nose, and Throat) and should be regarded as a medical emergency. This condition can be life-threatening due to the potential development of severe complications. These complications include but are not limited to airway blockage, paralysis of cranial nerves, mediastinitis (inflammation of the tissues in the mid-chest), compression or rupture of the internal carotid artery (which supplies blood to the brain), sepsis (a systemic infection), Disseminated Intravascular Coagulopathy (DIC) (a blood clotting disorder), and even death.¹

Statistics from a study conducted in 2018 in England revealed a mortality rate of 2.7% associated with deep neck abscess. Furthermore, another study by Huang et al. in China reported a significantly higher mortality rate of 18.18% for cases involving abscesses occurring in multiple locations. At Hasan Sadikin Hospital in Bandung, Indonesia, the mortality rate attributed to deep neck abscess was found to be 11% during the period from January to December 2012.¹⁻³

Deep neck abscess is defined as the formation of a localized collection of pus within the potential space between the layers of deep neck fascia. This collection of pus occurs as a result of tissue damage and the spread of infection from various sources, including the teeth, mouth, throat, paranasal sinuses, middle ear, and neck. The specific source of infection determines the location of the abscess within the deep neck fascia. It is crucial to identify and treat deep neck abscess promptly to prevent the development of life-threatening complications and reduce the risk of mortality.⁴⁻⁵

Despite the decreasing incidence and mortality of deep neck abscess due to the discovery of penicillin and improved dental care, this condition still poses challenges in terms of early diagnosis and management to avoid fatal complications.⁶

Several factors influence the success of managing deep neck abscess. These factors include age, gender, socioeconomic status, abscess location, etiology, and comorbidities. A study conducted by Barber et al. in Canada from 2007 to 2011 demonstrated that the location of residence, level of education, and microbiological characteristics affect the severity of deep neck abscess cases. Various predisposing factors such as peritonsillar infection, upper respiratory tract infection, poor oral hygiene, and dentogenic infection can influence the development of deep neck abscess.⁷

Ensuring successful management in patients diagnosed with deep neck abscess involves implementing timely and comprehensive treatment strategies. This includes prioritizing various aspects of care, such as early and appropriate interventions, effective control of the airway, administration of suitable antibiotic therapy, and considering the need for aspiration or surgical procedures based on individual indications.

The key to successful management lies in promptly initiating the appropriate treatment regimen. Timeliness is crucial, as delays in intervention can exacerbate the condition and increase the risk of complications. By recognizing the urgency of the situation, healthcare professionals can take immediate action to address the deep neck abscess.

Airway control is of paramount importance in managing deep neck abscess. Due to the potential for airway obstruction, it is crucial to ensure the patient's airway remains patent and unobstructed. This may involve employing techniques such as intubation or tracheostomy to secure a clear airway and facilitate adequate breathing.⁸

Another vital component of effective management is administering appropriate antibiotic therapy. Timely initiation of antibiotics helps combat the underlying infection and prevents its further spread. The choice of antibiotics should be guided by the suspected causative pathogens and their susceptibility patterns. Additionally, healthcare providers should carefully monitor the patient's response to the prescribed antibiotics and make adjustments as needed. The majority of management procedures performed for deep neck abscess cases at Dr. Hasan Sadikin Hospital in Bandung are operative procedures, namely incision and drainage with antibiotic administration (43%) according to other studies.^{4,6}

Considering the high mortality rate and complications associated with this disease, it is necessary to investigate the factors related to deep neck abscess at Dr. Hasan Sadikin Hospital in the ENT (Ear, Nose, and Throat) department. Research in this area has not been conducted at the hospital, so this study is conducted to determine the factors associated with deep neck abscess in the ENT department of Hasan Sadikin Hospital in Bandung.

METHOD

This study was conducted using a cross-sectional descriptive method. The research data utilized secondary data in the form of medical records of inpatients with deep neck abscess treated at Dr. Hasan Sadikin Hospital in Bandung, with a minimum required sample size of 113.

Study Subjects

The subjects of the study were the medical records of inpatients with deep neck abscess treated in the ENT (Ear, Nose, and Throat) department of Dr. Hasan Sadikin Hospital in Bandung, who met the inclusion and exclusion criteria.

Inclusion and Exclusion Criteria

The inclusion criteria for this study were patients diagnosed with deep neck abscess from January 2015 to December 2019, while the exclusion criteria were cases with incomplete data in the medical records.

Definition of Variables

Deep neck abscess is a localized collection of pus formed within the potential space between the deep neck fascia, resulting from tissue damage and the spread of infection from various sources such as teeth, mouth, throat, paranasal sinuses, middle ear, and neck,

depending on which space is involved.⁵ The patient's age was calculated by subtracting the year of examination from the year of birth. Then, gender refers to the biological sex assigned at birth. Occupation represents a series of tasks designed to be performed by one person in exchange for compensation based on the severity of the work. Place of residence refers to the domicile or address where one usually resides. The abscess location refers to the space along the neck that is involved in the infection. Etiology represents the underlying condition of deep neck abscess. Bacteriology refers to the pathogenic bacteria causing deep neck abscess. Comorbidities refer to concurrent diseases present in patients with deep neck abscess. Some comorbidities associated with deep neck abscess in this study are diabetes mellitus, hypertension, renal failure, and sepsis. Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia and disturbances in carbohydrate, fat, and protein metabolism due to abnormalities in insulin secretion, insulin action, or both. In diabetic patients, HbA1c levels are found to be >6.5% and fasting blood sugar levels >126 mg/dL or blood sugar levels 2 hours after meals above 200 mg/dL.⁸ HbA1c levels with clinical significance for deep neck abscess are $\geq 7.0\%$.⁹

Acute kidney failure is a clinical condition characterized by an increase in serum creatinine levels >0.3 mg/dL (>26.5 $\mu\text{mol/L}$) within <48 hours or an increase in serum creatinine levels >1.5 times within <7 days, or urine output <0.5 mL/kg/hour for 6 hours.¹⁰ Hypertension is diagnosed when systolic blood pressure is >140 mmHg and/or diastolic blood pressure is >90 mmHg upon measurement.¹¹ Sepsis is a manifestation of systemic inflammatory response syndrome that has >2 criteria, such as temperature >38°C or <36°C, heart rate >90 beats per minute, respiratory rate >20 breaths per minute or PaCO₂ <32 mmHg, and white blood cell count >12,000 cells/mm³ or 10% immature cells.^{6,7}

Testing Instruments

The required tool for this study is the medical records of inpatients with deep neck abscess treated at Dr. Hasan Sadikin Hospital in Bandung.

Statistical Analysis

The collected data will be analyzed descriptively and presented as numbers and percentages for categorical data in the form of tables.

Research Ethics

The author conducted the research after obtaining ethical approval from the Ethics Committee of the Faculty of Medicine, Padjadjaran University, and research approval from the training department of Dr. Hasan Sadikin Hospital in Bandung. This study obtained ethical approval with No: LB.02.01/X.6.5/106/2020. The research also obtained research permission issued by the Education and Research Department of Dr. Hasan Sadikin Hospital with No: LB.02.01/X.2.2.1/12994/2020.

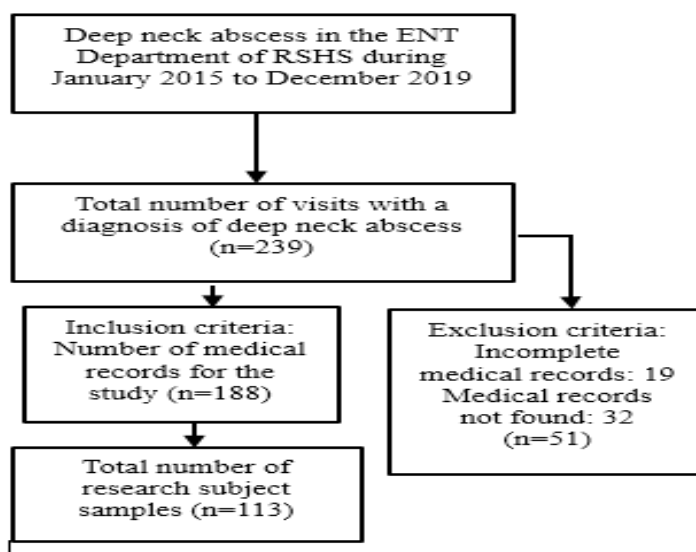


Figure 1. Flowchart of research subjects

RESULTS

The majority of patients with deep neck abscess are male (n=66; 58.4%). The proportion of patients who recovered is higher among males (n=59; 89.4%), while the proportion of deaths is higher among females (n=7; 14.9%).

The socioeconomic status of the majority of patients affected by deep neck abscess is the working group (n=86; 76.1%). The highest

mortality rate is found in the working group (n=12; 14%). The geographical residence of patients with deep neck abscess is predominantly in rural areas (63.7%), and the highest mortality rate is observed among patients residing in rural areas (15.3%). The number of rural patients who recovered is 61 (84.7%). Among patients residing in urban areas, 38 patients (92.7%) recovered, and 3 individuals (7.3%) died

Table 1. Subject Demographics

Characteristics	n (%) (n=113)	Recovery (n=99)	Mortality (n=14)
Age (years)			
1-9	1 (0.9)	1 (100)	0 (0.0)
10-19	6 (5.3)	6 (100)	0 (0.0)
20-60	87 (77)	79 (90.8)	8 (9.2)
>60	19	13 (68.4)	6 (31.6)
Gender			

Male	66	59 (89.4)	7 (10.6)
Female	47	40 (85.1)	7 (14.9)
Occupation			
Employed	86	74 (86)	12 (14)
Unemployed	27	25 (92.6)	2 (7.4)
Place of residence			
Rural	77	61 (84.7)	11 (15.3)
Urban	41	38 (92.7)	3 (7.3)

The location of deep neck abscesses is most commonly found in multilocular areas (n=61; 54%). The highest mortality rate is observed in patients with parotid abscesses with a percentage of 50%, followed by multilocular abscesses with 19.7% and submandibular space abscesses with 8.4%. The highest number of patients who achieved recovery are in the peritonsillar abscess group

(n=33; 100.0%), retropharyngeal abscess group (n=3; 100%), and parapharyngeal abscess group (n=2; 100.0%).

The most common cause of deep neck abscesses is odontogenic infection (55.8%; mortality rate 17.5%). The group with the highest recovery rate among the causes of deep neck abscesses is epiglottitis (n=2; 100%), followed by mixed infection of tonsillitis and odontogenic infection (n=1), and odontogenic epiglottitis (n=1)

Table 2. Characteristics of deep neck abscess

Characteristics	n (%) (n=113)	Recovery (n=99)	Mortality (n=14)
Abscess location			
3 (2.7)	3 (100.0)	0 (0.0)	

Retropharyngeal	2 (1.8)	2 (100.0)	0 (0.0)
Parapharyngeal	12 (10.6)	11 (91.6)	1 (8.4)
Submandibular	2 (1.8)	1 (50.0)	1 (50.0)
Parotid	61 (53.9)	33 (54.1)	0 (0.0)
Peritonsillar	67 (59.3)	61 (91.0)	12 (17.9)

Multilocation	33	49 (80.3)	
Etiology	(29.2)		11 (17.5)
Dental origin	61	52 (82.5)	2 (4.9)
Tonsillitis	(54.0)	39 (95.1)	1 (50.0)
Parotitis		1 (50.0)	0 (0.0)
Epiglottitis	63	2 (100.0)	0 (0.0)
Tonsillitis,	(55.8)	4 (100.0)	
dental origin	41		0 (0.0)
Epiglottitis,	(36.3)	1 (100.0)	
dental origin	2 (1.8)		
Bacterial	2 (1.8)		
culture results	4 (3.5)		2 (11.2)
Aerobic		16 (88.8)	1 (2.7)
Anaerobic	1 (0.9)	37 (97.3)	6 (16.7)

Polymicrobial	30 (83.3)	5 (23.8)
No bacterial growth	16 (76.2)	
	18	
	(15.9)	
	38	
	(33.6)	
	36	
	(31.9)	
	21	
	(18.6)	

Based on the results of specimen cultures, the most common cause of deep neck abscesses is anaerobic bacteria (n=38; 33.6%). The highest mortality rate is observed in the group with no bacterial growth (23.8%), followed by polymicrobial infections (16.7%). The highest rate of recovery is found in the anaerobic bacteria group (n=37; 97.3%).

22.7%. There are 16 cases (14.2%) of comorbid hypertension, with 12 cases (10.6%) classified as stage 2 hypertension. The highest number of patients who recovered is in the stage 2 hypertension group (n=10; 83.3%).

The number of patients with comorbid acute kidney injury is 15 cases (13.3%) with the highest number of patient deaths among all comorbidities, which is 6 patients (40.0%). The highest mortality

The order of comorbidities in deep neck abscesses based on the percentage is as follows: diabetes mellitus (DM) (19.5%), hypertension (14.2%), acute kidney injury (13.3%), and sepsis (8.8%). The most common comorbidity found in patients with deep neck abscesses is diabetes mellitus (n=22; 19.5%) with a mortality rate of

rate is observed in the group with stage 1 acute kidney injury, with 3 patients (50.0%). The highest number of patients who recovered is in the stage 2 and 3 kidney failure group (66.7%).

The number of patients with comorbid sepsis is 10 cases (8.8%) with a mortality rate of 5 patients (50.0%), and a recovery rate of 5 patients (50.0%)

Table 3. Distribution of comorbidities

Comorbidities	n (%)	Recovery (n=99)	Mortality (n=14)
Diabetes mellitus (DM)			
HbA1c >7%	22	17 (77.3)	5 (22.7)
HbA1c <7%	(19.5)	82 (90.1)	9 (9.9)
Hypertension	91		
Optimal	(80.5)	17 (85.0)	3 (15.0)
Normal		40 (93.0)	3 (7.0)
High normal	20	30 (91.1)	4 (8.9)
Stage 1	(17.7)	2 (50.0)	2 (50.0)
Stage 2	43	10 (83.3)	2 (16.7)
Acute kidney injury	(38.1)		
Normal	34	90 (91.8)	8 (8.2)

Stage 1	4 (3.5)	3 (50.0)	3 (50.0)
Stage 2	12	2 (66.7)	1 (33.3)
Stage 3	(10.6)	4 (66.7)	2 (33.3)
Sepsis			
Yes		5 (50.0)	5 (50.0)
No	98	94 (91.3)	9 (8.7)
	(86.7)		
	6 (5.3)		
	3 (2.7)		
	6 (5.3)		
		10 (8.8)	
		103	
		(91.2)	

Patients with deep neck abscesses have several calculated risk factors, with the three largest being patients with 3 risk factors (n=29; 25.7%), 4 risk factors (n=26; 21.2%), and 5 risk factors and having dentogenic infection (n=65; 55.8%).

(n=25; 18.6%). There are three major factors associated with the successful management of deep neck abscesses, namely residing in rural areas (n=72; 63.7%), being male (n=66; 58.4%),

Table 4. Distribution of the number and proportion of multifactorial risks for deep neck abscess

Number of risk factors	n (%)	Recovery (n=99)	Mortality (n=14)
1	2 (1.8)	2 (100.0)	0 (0.0)
2	13	13	0 (0.0)
3	(11.5)	(100.0)	0 (0.0)

4	29	29	2 (7.7)
5	(25.7)	(100.0)	6 (24.0)
6	26	24 (92.3)	2 (28.6)
7	(21.2)	19 (76.0)	2 (33.4)
8	25	5 (71.4)	2 (40.0)
	(18.6)	4 (66.6)	
	7 (9.7)	3 (60.0)	
	6 (5.3)		
	5 (4.4)		

DISCUSSION

The incidence rate of deep neck abscesses in this study was found to be 4.2% with a mortality rate of 12.4%. Previous studies at RS Hasan Sadikin Bandung reported a mortality rate of 11% due to deep neck abscesses.¹⁰

A significant portion of individuals afflicted with deep neck abscesses consisted of adults falling within the age range of 20 to 60 years. However, it is noteworthy that the age group exceeding 60 years exhibited the highest mortality rate, reaching 31.6%. These findings align with a previous investigation conducted by Lee et al. in Singapore between 2004 and 2009, which reported a median age of 51 years (with a range of 17 to 90 years) among patients diagnosed with deep neck abscesses. The consistency observed across these studies emphasizes the influential role of age in both the presentation and outcomes of deep neck abscesses.^{7,8}

It is imperative to recognize that elderly patients and adult patients with deep neck abscesses exhibit distinct characteristics and necessitate differentiated considerations in their management. As individuals age, they experience age-related changes in their immune system, including a decline in the functioning of neutrophils. Neutrophils play a vital role in combating bacterial infections, and the compromised bactericidal function of neutrophils in elderly patients renders them more vulnerable to deep neck infections. This increased susceptibility in the elderly population may contribute to the higher mortality rate observed in patients aged 60 years and older.^{4,6}

Comprehending the age-related differences in deep neck abscesses holds paramount importance for healthcare providers when formulating treatment strategies and delivering appropriate care. Elderly patients may require additional monitoring, meticulous observation, and specialized interventions to address their unique physiological vulnerabilities. By acknowledging and accounting for the specific challenges faced by elderly individuals with deep neck abscesses, healthcare professionals can tailor their approach to optimize outcomes and minimize complications. Elderly patients often have accompanying systemic diseases, are more prone to multiloculated deep neck abscesses, complications, prolonged hospitalization, and surgical interventions. Male patients are more commonly found among those with deep neck abscesses. This could be due to the easier spread of infections to potential spaces in males due to differences in the strength of loose connective tissue between males and females. Loose connective tissue in males is often found to be less vascularized. Additionally, males tend to neglect oral hygiene and have a higher prevalence of smoking habits.^{1,7}

Patients with low socioeconomic status have the potential to experience complications from deep neck abscesses. Patients with low educational levels will affect the prognosis of the given management. In contrast to previous studies, the findings of this study revealed a significant distinction in the demographic characteristics of patients suffering from deep neck abscesses. Notably, a substantial majority of patients diagnosed with deep neck abscesses were actively employed individuals, comprising 76.1% of the study population. Surprisingly, it was discovered that the group of working patients exhibited the highest mortality rate, with a concerning 14% succumbing to the condition. These results deviate from the previously documented studies and shed light on a previously unrecognized association between occupational status and the mortality risk associated with deep neck abscesses.^{6,8}

Furthermore, the socioeconomic backgrounds of the patients in this study differed from the existing literature. Kumar et al. reported

that a significant proportion of patients with deep neck abscesses hailed from lower-middle-class or low-income backgrounds, accounting for 49.6% of the study population. This discrepancy emphasizes the impact of socioeconomic factors on the incidence and outcomes of deep neck abscesses, underscoring the need for a comprehensive understanding of the social determinants of health.⁴

The unexpected higher mortality rate observed among working patients warrants further investigation and exploration into potential underlying factors. It is plausible that the occupational demands and stressors faced by these individuals may contribute to a compromised immune response or delayed access to timely medical care, thereby increasing the severity and fatality of deep neck abscesses. Additionally, socioeconomic factors, such as limited access to healthcare resources and financial constraints, may further compound the challenges faced by patients from lower-middle-class or low-income backgrounds, potentially exacerbating the mortality risk.^{3,4}

Recognizing the influence of occupational status and socioeconomic background on the outcomes of deep neck abscesses is critical for healthcare professionals. By integrating these factors into the diagnostic and treatment strategies, healthcare providers can enhance patient care and implement targeted interventions that address the specific needs of working patients and those from disadvantaged socioeconomic backgrounds. This holistic approach aims to mitigate the mortality risk associated with deep neck abscesses in these vulnerable populations. This occurs because these patients do not have enough money to seek treatment at hospitals, resulting in delayed management. Although this study found that working patients were more affected by deep neck abscesses, there is no further explanation regarding the type of occupation and the patients' income.⁹

Urban areas are correlated with difficulties in accessing healthcare services, where Pandey et al. mentioned that there was a 40.87% delay in managing deep neck abscess cases for 5-6 days in India due to the geographical conditions of the mountains. The involvement of multiple neck spaces (multiloculated) plays an important role in influencing the success of management. The unique anatomy of interconnected deep neck spaces facilitates the spread of abscesses to multiple locations (multiloculated). The highest mortality rate was found in patients with parotid abscesses (50%), where in cases of parotid abscesses, the abscess easily spreads through the stylomandibular tunnel to the parapharyngeal space. Infection can easily enter the carotid and superior spaces of the mediastinum, leading to mediastinitis.²¹

Dentogenic infection is the most common cause of deep neck abscess, consistent with previous study findings.^{5,13} Infections that occur in the teeth have the potential to spread to the upper jaw and enter the masticator, spreading to the pterygomaxillary space, infratemporal fossa, and parapharyngeal space. Infections in the lower jaw, if they affect the second and third molars, can enter the submandibular cavity and then spread to the parapharyngeal and visceral spaces. Unlike infections in the first molar, this infection can initially enter the sublingual space, then enter the submandibular space, and ultimately enter the parapharyngeal and visceral spaces.¹⁰

A study states that anaerobic bacteria are commonly found in cases of deep neck abscesses due to the low oxygen pressure in the loose connective tissue area of the neck spaces. Therefore, such conditions can provide a favorable growth synergy for anaerobic bacteria. Mortality is more frequently found in the group where no bacterial growth is present, which can occur due to antibiotic

administration before incision and drainage procedures are performed.

Patients with diabetes mellitus (DM) have a higher incidence of complications (37%) compared to patients without DM (28%) in a study. The mechanisms identified in DM patients regarding infection include increased oxidative stress, advanced glycation end-products, impaired immune function, and changes in collagen. Oxidative stress arises from the effects of hyperglycemia and increased circulating fatty acids in the blood. Hyperglycemic conditions can enhance the formation of superoxide in mitochondria. Hypertension can cause microcirculation dysfunction in tissues, which can lead to tissue abnormalities and affect the patient's wound healing process. In patients with kidney failure, uremia can cause an imbalance of pro- and anti-inflammatory factors, which can disrupt the immune response in the patient's body through the formation of reactive oxygen species (ROS) within cells, decreased dendritic cell function, and CD4/CD8 T-cell dysfunction. Sepsis caused by odontogenic infection is a life-threatening condition due to an abnormal immune system response. Currently, there is no research describing the mortality rate of sepsis caused by deep neck infections. Pota et al.'s study mentions that cases of sepsis caused by deep neck abscesses with mediastinitis complications are caused by the effects of gram-negative and gram-positive bacterial endotoxins, such as lipopolysaccharide layers, which can worsen sepsis conditions and lead to antibiotic resistance.

The most prevalent risk factors found in cases of deep neck abscesses are residing in rural areas, being male, and having odontogenic infections. The multifactorial risks associated with deep neck abscesses in the study include gender, age, occupation, place of residence, abscess location, initial infection causing the deep neck abscess, bacterial type, and comorbid diseases.⁶⁻⁸

The results of this study indicate the need for promotive and preventive actions for dental and oral hygiene, as well as education on comorbid factors such as diabetes mellitus (DM) and hypertension, to prevent deep neck abscesses. Further in-depth research on factors such as smoking, alcohol consumption, and socioeconomics, such as occupation type, income level, and comorbid history, needs to be conducted to examine their association with deep neck abscesses.¹⁰

This study still has unexplored characteristics of the research subjects that need further investigation, such as a history of smoking and alcohol consumption, socioeconomic factors related to occupation type and income level in patients with deep neck abscesses, and the duration of comorbid diseases such as DM and hypertension. Therefore, further research is needed.

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