

Factors associated with poor prognosis in deep neck infections

Derin boyun enfeksiyonlarında kötü prognoz ile ilişkili faktörler

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ABSTRACT

Deep neck infections still remain one of the important causes of morbidity, although their prevalence has been diminished with modern antimicrobial therapy. The target of the retrospective is to demonstrate our experience in the treatment of serious cases of deep neck infections (phlegmons) and to identify the predictors of a possibly poor outcome. This retrospective study comprised 44 patients with neck phlegmons, who were treated at the ENT Clinic, during 2000-2016. The study included the etiology, predisposing factors, causative microbiological organisms, and the clinical outcomes associated with the mortality. During investigated time period, 44 patients with deep neck infections (phlegmons) were noted. The median age of the patients was 45.9 years (range, 14-81), and study population included 26 males (59%). The median hospital stay was 22.5 days (from 3-80 days). *Staphylococcus aureus* was the most commonly isolated bacteria. Death was noted in 10 patients (22.7%). Timely diagnosis together with aggressive surgical treatment and appropriate antibacterial therapy were the key to success in the treatment of the patients with deep neck infections. The factors associated with poor prognosis in our patients included tonsillar disease, diabetes mellitus, mediastinitis, age above 65 years.

Keywords: Deep neck infections, predictors, poor outcome

ÖZ

Modern antimikrobiyal tedavilerin gelişmesi ile derin boyun enfeksiyonlarının görülme sıklığının azalmasına karşın derin boyun enfeksiyonları halen morbiditenin önemli nedenlerinden biridir. Bu retrospektif çalışma, ciddi derin boyun enfeksiyonlu vakalarda (flegmonlar) uyguladığımız tedavi deneyimlerimizi göstermekte ve olası kötü prognostik faktörleri tanımlamayı hedeflemektedir. Çalışmaya 2000-2016 yılları arasında KBB kliniğinde tedavi edilen 44 boyun flegmonlu hasta dahil edilmiştir. Çalışmada etiyolojik faktörler, predispozan faktörler, enfeksiyona neden olan mikrobiyolojik ajan ve mortalite ile ilişkili klinik bulgular incelenmiştir. İncelenen süre aralığında 44 derin boyun enfeksiyonlu (flegmon) olgu görülmüştür. Hastaların ortalama yaşının 45.9 (14-81 yaş aralığında) ve 26'sının erkek (%59) olduğu saptandı. Hastaların ortalama hastanede kalış süresinin 22.5 gün (3-80 gün arası) olarak saptandı. En çok izole edilen bakterinin *S. Aureus* olduğu saptandı. Takip süresince 10 hasta yaşamını kaybetti (%22,7). Derin boyun enfeksiyonlarında başarılı bir tedavinin ana noktaları; doğru zamanda tanı koymak, uygun antibakteriyel tedavi ile birlikte agresif cerrahi tedavidir. Hastalarımızda kötü prognoz ile ilişkili olan faktörlerin tonsiller tutulum, diyabetes mellitus ve 65 yaş üzerinde olmak olduğu görülmüştür.

Anahtar kelimeler: Derin boyun enfeksiyonu, prognostik faktör, kötü prognoz

INTRODUCTION

Deep neck infection (phlegmons) presents a serious condition which can end lethally. It demonstrates a challenging problem because of its complex anatomy, deep location, deep access, and communication with vital structures.

Neck phlegmon remain a significant cause of morbidity, although their prevalence has been diminished

with modern antimicrobial therapy. Neck phlegmons of dental and adenotonsillar origin are the most common ones but they may also arise from several other foci of head and neck^{1,2}.

Early stage of the disease looks like abscess and cellulitis. This benign image is the most important reason behind late diagnosis. But, cellulitis can be a very dangerous disease because of its tendency to spread the infection through blood or lymph and deeper pe-

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netration into the structure causing severe forms of necrotizing fasciitis³. It is of great significance to find out on time the unfavorable progression of the disease and the propagation of the infection into other regions of the neck and the mediastinum. It is of special threat to the development of cervical necrotizing fasciitis. In the discrimination of the necrotising from non-necrotising type of the soft tissue infection is of big help to use the laboratory risk indicator for necrotizing fasciitis score (LRNEC), created by Wong et al.⁴.

Aim of this paper: to identify the predictors of poor outcome of the deep neck infection (phlegmons).

MATERIAL and METHODS

This retrospective study comprised 44 patients with neck phlegmons who were treated in the Ear-Nose-Throat Clinic, University Clinical Center of Tuzla, Bosnia and Herzegovina, between January 2000 and December 2016. The study included the etiology, predisposing factors, causative microbiological organisms, and the clinical outcomes associated with the mortality.

We used Laboratory Risk Indicator for Necrotizing Fasciitis score (LRINEC), a tool for distinguishing necrotizing fasciitis from other soft tissue infections, according to Wong⁴. They compared a set of laboratory variables between patients with and without necrotizing soft tissue infection (NSTI) and identified 6 independent variables (C-reactive protein, WBC count, levels of hemoglobin, sodium, creatinine, and glucose).

Fisher's Exact Chi-Square Test was used for the statistical analysis. QuickCalcs Scientific Software was used to process data. Values of $p < 0.05$ were taken as statistically significant.

RESULTS

During the study period, 44 patients with deep neck infections (phlegmons) were noted (26 males, 18 females, mean age 45.9 years, range 14 to 81). The me-

dian hospital stay was 22.5 days (3 to 80 days).

Before hospitalization, all patients were treated with antibiotics in general practice. During the admission to the clinic, the patients had sore throat or toothache, and diffuse swelling of the neck. Twenty-five patients were afebrile, 12 patients were febrile (37-38°C). Hypoalbuminemia was noted in 21 cases (47.7%). All patients underwent surgical procedure under general anesthesia. Cervical exploration and cervical mediastinotomy were performed within 24 hours after admission. All patients had undergone tracheotomy. The patients were fed through the nasogastric tube. Ten patients (22.7%) had mediastinitis, and two of them had diffuse form of mediastinitis. Dressings of the wounds were performed on a daily basis in general anesthesia until the improvement of local and general symptoms of the inflammation. Death was noted in 10 patients (22.7%), with a median age of 60.1 years (range, 26-78). In 8 (80%) patients older than 65 years 5 (50%) cases of mediastinitis were detected.

Antibiotic therapy was the treatment used in all cases. The most commonly used initial antibacterial therapy was a combination of 3 antibiotics (Crystallin amp. 6x4 mil. i.u, Garamycin amp. 2x120 or 80 mg, Metronizol amp. 3x500 mg). The therapy was later adjusted according to microbiological findings.

Pus was collected for culture during the surgical procedure. Bacteria were discovered in specimens taken during the incision in 26 (59.1%) of patients. Different bacteria were isolated including *Pseudomonas*, *Peptostreptococcus* sp, *Streptococcus* sp, MRSA, *Klebsiella pneumoniae*, *Escherichia coli*, *Proteus mirabilis*, *Enterobacter*.

To determine the differences in etiologies and comorbidities among patients, Fisher's Exact chi-Square Test was used. Based on the p value, it was observed that in the surviving patients and patients with lethal outcomes there was a statistically significant difference in the occurrence of diabetes mellitus (< 0.001) and the total number of patients without comorbidity (< 0.001) (Table 1).

Table 1. Etiology and comorbidity patients (pts) with neck phlegmons (44).

	Disease	Surviving pts (34)		Surviving pts (34)		p
		N	%	N	%	
Etiology	Tonsillar disease	17	50.0	7	70.0	0.306
	Other	17	50.0	3	30.0	
	Caries dentes	13	38.2	1	10.0	0.132
	Other	21	61.8	9	90.0	
	Foreign body of esophagus	0	0.0	1	10.0	0.227
	Other	34	100.0	9	90.0	
	Epiglottitis	0	0.0	1	10.0	0.227
	Other	34	100.0	9	90.0	
	Unknown	4	11.8	0	0.0	0.559
	Other	30	88.2	0	0.0	
Comorbidity	DM	6	17.7	7	70.0	<0.001*
	Other	28	82.3	3	30.0	
	HTA	4	11.8	2	20.0	0.606
	Other	30	88.2	8	80.0	
	DM+HTA	0	0.0	1	10.0	0.227
	Other	34	100.0	9	90.0	
	Lymphoma	1	2.9	0	0.0	1.000
	Other	33	97.1	10	100.0	
	Hypothireosis	1	2.9	0	0.0	1.000
	Other	33	97.1	10	100.0	
	Chronic renal failure	0	0.0	1	10.0	0.227
	Other	34	100.0	9	90.0	
	Atrial fibrillation+DM	0	0.0	1	10.0	0.227
	Other	34	100.0	9	90.0	
	Without comorbidity	23	67.6	1	10.0	<0.001*
Other	11	32.4	9	90.0		

DM-Diabetes mellitus; HTA-Hypertensio arterialis; Fisher's Exact Chi-Square Test (p value)

* Highly significant

DISCUSSION

Deep neck abscesses and phlegmons are relatively rare inflammations requiring urgent treatment, because of the involvement of vital neck structures and communications between deep neck space and mediastinum. In our retrospective study we showed 44 patients with serious cases of deep neck infection (phlegmons) within a 16-year period. The infections have been seen more often in males (59%), which is compatible with previously published works⁵⁻⁷.

The median age of our patients was 45.9 years which was compatible with previously published works. In the literature studies mostly individuals aged 36-57 years were affected by the disease^{8,9}.

In our patients the etiologies of neck flegmons

were most commonly tonsillar disease 24 (54.5%), and dental caries 14 (31.8%). Deep neck infections of unknown primary origin were noted in 4 (9.1%) patients. Sakagushi et al.¹, Wang et al.¹⁰, Lee et al.¹¹ reported a significant proportion of deep neck infections of unknown primary origin in 16-39% of their patients. Up to 70% of DNI cases corresponded to pharyngotonsillar infections in the pre-antibiotic era. However, there has been an important decline of its incidence in recent times, as shown by lots of studies^{12,13}. According to Lorenzini et al.¹⁴ and Zhang et al.¹⁵ the main reasons for the DNI are odontogenic infections and trauma. Although tonsillar disease are very common in childhood, in our study we have not recorded a neck flegmon in children. This is the result of good antibiotic therapy of infections and good treatment of childhood comorbidities.

Osborn et al.¹⁶ reported the most frequent comorbidities found in the patients with DNI as diabetes mellitus, chronic hepatitis, renal insufficiency and immunodepression. The most frequent comorbidities in our study are encountered in patients with diabetes mellitus (25%), and mortality rate of 50%. More than half (54.5%) of the patients were without comorbidity, that is compatible with results obtained by other authors, who reported a major incidence of diabetes among the diseases associated with patients with DNI as well.

The DNIs are generally polymicrobial. In our study the most frequent bacteria found in all patients were *Staphylococcus aureus* in 9 (20.5%), and *Acinetobacter* spp. in 5 (11.4%) patients. In patients with mortal outcomes *Staphylococcus aureus* (n=1 :10%), and *Acinetobacter* spp. (n=1 ;10%) were detected and in 4 (40%) microbiological specimens were sterile. Parhiscer et al.⁵, Blomquist et al.¹⁷, Sethi⁷ published similar results. Authors published that the most frequent bacteria were *Streptococcus viridiana*, and *Staphylococcus aureus*. On the other hand, Roscoe et al.¹⁸ and Caccamese et al.¹⁹ detected *Streptococcus viridana*, *Streptococcus milleri*, *Prevotella* spp, *Peptostreptococcus* spp and *Klebsiella pneumoniae*. The latter is more common in diabetic patients.

In our patients we noted negative microbiological findings in the wound in 40.9% of the patients which is compatible with the study results reported by Sethi⁷, Lin et al.²⁰ about DNI, which noted negative (sterile) microbiological findings of the wound site in 27-40% of their patients. Microbiological findings of the wound and antibiogram is a powerful weapon in curing deep infections of the neck (DNI) and in case of a negative (sterile) findings of the wound appearing in a bad local finding is an aggravating condition.

Bilbaut et al.²¹ and Flagan et al.²² published that hyperbaric oxygen and intravenous immune globulin treatment decrease the mortality rate. In one patient we successfully applied intravenous immunoglobulins, while hyperbaric oxygen was not applied.

In our study we noted lethal outcome in 10 patients (22.7%), including mediastinitis 8 (80%) patients. In the group of deceased patients 7 (70%) of them had very high fever necessitating their acceptance to the hospital and diabetes mellitus was detected in 50% of the cases. In the published works on DNI, the data about mortality rates published by Jones²³; McHenry²⁴ Wang et al.¹⁰, Har et al.²⁵, Lee et al.¹¹ varied greatly (34%, 46%, and 0.7%). Descending necrotizing mediastinitis (DNM) which usually occurs as a complication of DNIs complication is one of the most lethal forms of mediastinitis.

In our study 10 patients (22.7%) had mediastinitis, from which 8 of them had upper mediastinitis so the transcervical drainage was performed. In two patients, because of the diffuse mediastinitis, we performed debridement through a standard thoracotomy incision.

It is a rapidly progressing infection even if cases are rare. Out of all head and neck infections only 2.6% are cervical necrotizing fasciitis, and the mortality rate in these cases varies between 19% and 40%²⁶.

To maintain airway patency is of extreme importance. The conditions did not improve with standard methods including aspiration of secretions. We performed tracheoscopy with rigid instrument and remove 3.5x1.3 cm plug that consisted of secretions coming from the lungs, mixed with dry blood. (Figure 1). Plug imitated foreign body in the trachea.



Figure 1. Tracheal plug.

And finally, a dilemma during treatment of neck phlegmons exists which an experienced otolaryngologist should fight against. How many disinfectants, which are used for aggressive treatment of wounds, affect the tissue necrosis and thus contribute to the spread of infection?

Recommendation: Spread of infection, occurrence of mediastinitis, and also possible development of cervical necrotizing fasciitis should be kept in mind. Neck phlegmons are treated using a multidisciplinary approach.

CONCLUSION

On the basis of our study we can conclude that the predictors of poor prognosis in our patients with DNI are associated conditions as tonsillar disease, diabetes mellitus, age above 65 years, mediastinitis.

REFERENCE

- Sakagushi M, Sato S, Ishiyama T, et al. Characterization and management of deep neck infection. *J Oral Maxillofac Surg.* 1997;26:131-4. [https://doi.org/10.1016/S0901-5027\(05\)80835-5](https://doi.org/10.1016/S0901-5027(05)80835-5)
- Coelho MS, Ramos G, Prestes LC, et al. Deep Neck Infections - Classification in Levels of Severity. *Intl. Arch. Otorhinolaryngol.* 2009;13:184-8.
- Hadzovic-Cengic M, Sejtarija-Memisevic A, Koluder-Cimic N, et al. Cellulitis--epidemiological and clinical characteristics. *Med Arch.* 2012;66(3 Suppl 1):51-3. <https://doi.org/10.5455/medarh.2012.66.s51-s53>
- Wong CH, Khin LW, Heng KS, et al. The LRINEC (laboratory risk indicator for necrotizing fasciitis) score: a tool for distinguishing necrotizing fasciitis from other soft tissue infections. *Crit Care Med.* 2004;32:1535-41. <https://doi.org/10.1097/01.CCM.0000129486.35458.7D>
- Parhiscar A, Har-El G. Deep neck abscess: a retrospective review of 210 cases. *Ann Oto Rhinol Laryngol.* 2001;110(11):1051-4. <https://doi.org/10.1177/000348940111001111>
- Huang TT, Liu TC, Chen PR, et al. Deep Neck Infection: analysis of 185 cases. *Head Neck.* 2004;26:854-60. <https://doi.org/10.1002/hed.20014>
- Sethi DS, Stanley RE. Deep neck abscesses-changing trends. *J Laryngol Otol.* 1994;108(2):138-43. <https://doi.org/10.1017/S0022215100126106>
- Chen MK, Wen YS, Chang CC, et al. Deep neck infections in diabetic patients. *Am J Otolaryngol.* 2000;21(3):169-73. [https://doi.org/10.1016/S0196-0709\(00\)85019-X](https://doi.org/10.1016/S0196-0709(00)85019-X)
- Bahu SJ, Shibuya TY, Meleca RJ. Craniocervical necrotizing fasciitis: an 11-year experience. *Otolaryngol Head Neck Surg.* 2001;125(3):245-52. <https://doi.org/10.1067/mhn.2001.118182>
- Wang LF, Kuo WR, Tsai SM, Huang KJ. Characterizations of Life-Threatening Deep Cervical Space Infections: A review of one hundred ninety-six cases. *Am Journal of Otolaryngol.* 2003;24(2):111-7. <https://doi.org/10.1053/ajot.2003.31>
- Lee JK, Kim HD, Lim SC. Predisposing Factors of Complicated Deep Neck Infection: An Analysis of 158 cases. *Yonsei Med J.* 2007;48(1):55-62. <https://doi.org/10.3349/ymj.2007.48.1.55>
- Larawin V, Naipo J, Dubey SP. Head and neck space infections. *Otolaryngology - Head and Neck Surgery.* 2006;135:889-993. <https://doi.org/10.1016/j.otohns.2006.07.007>
- Marina Serrato Coelho, Gyl Ramos, Luciano Campelo Prestes, et al. de Oliveira, Paulo Lobo. Deep Neck Infections - Classification in Levels of Severity. *Intl. Arch. Otorhinolaryngol.* São Paulo. 2009;13(2):184-8.
- Lorenzini G, Picciotti M, Di Vece L, et al. Cervical necrotizing fasciitis of odontogenic origin involving the temporal region--a case report. *J Craniomaxillofac Surg.* 2011;39(8):570-3. <https://doi.org/10.1016/j.jcms.2010.05.002>
- Zhang WJ, Cai XY, Yang C, et al. Cervical necrotizing fasciitis due to methicillin-resistant *Staphylococcus aureus*: a case report. *Int J Oral Maxillofac Surg.* 2010;39(8):830-4. <https://doi.org/10.1016/j.ijom.2010.03.019>
- Osborn TM, Assael LA, Bell RB. Deep Space Neck Infection: Principles of Surgical Management. *Oral Maxillofacial Surg Clin N Am.* 2008;20:353-65. <https://doi.org/10.1016/j.j.coms.2008.04.002>
- Blomquist IK, Bayer AS. Life-threatening deep fascial space infections of the head and neck. *Infect Dis Clin North Am.* 1988;2(1):237-64
- Roscoe DL, Hoang L. Microbiologic Investigations for Head and Neck Infections *Infect Dis Clin N Am.* 2007; 21:283-304.
- Caccamese Jr JF, Coletti DP. Deep Neck Infections: clinical considerations in aggressive disease. *Oral Maxillofacial Surg.* 2008;20:367-80. <https://doi.org/10.1016/j.j.coms.2008.03.001>
- Lin C, Yeh FL, Lin JT. Necrotizing fasciitis of the head and neck: an analysis of 47 cases. *Plast Reconstr Surg.* 2001;107(7):1684-93. <https://doi.org/10.1097/00006534-200106000-00008>
- Billbault P, Castelain V, Schenck-Dhif M, et al. Life-threatening cervical necrotizing fasciitis after a common dental extraction. *Am J Emerg Med.* 2008;26(8):971 e975-7.
- Flanagan CE, Daramola OO, Maisel RH, et al. Surgical debridement and adjunctive hyperbaric oxygen in cervical necrotizing fasciitis. *Otolaryngol Head Neck Surg.* 2009;140(5):730-4. <https://doi.org/10.1016/j.otohns.2009.01.014>
- Jones J. United States Sanitary Commission, Surgical Memoirs of the war of the Rebellion. New York: Riverside Press; 1871. Investigation upon the nature, causes and treatment of Hospital Gangrene as it prevailed in the Confederate armies, 1861-1865 In: Hamilton FH, ed. pp. 146-70.
- McHenry CR, Piotrowski JJ, Petrinic D, Malangoni MA. Determinants of mortality for necrotizing soft-tissue infections. *Ann Surg.* 1995;221:558-63; discussion 563-5. <https://doi.org/10.1097/0000658-199505000-00013>
- Har-El G, Aroesty JH, Shaha A, Lucent FE. Changing trends in deep neck abscess. *Oral Med Oral Pathol.* 1994;77:446-50. [https://doi.org/10.1016/0030-4220\(94\)90221-6](https://doi.org/10.1016/0030-4220(94)90221-6)
- Bono G, Argo A, Zerbo S, et al. Cervical necrotizing fasciitis and descending necrotizing mediastinitis in a patient affected by neglected peritonsillar abscess: a case of medical negligence. *J Forensic Leg Med.* 2008;15(6):391-4. <https://doi.org/10.1016/j.jflm.2007.12.008>