Evaluation of Deep Neck Infections in Childhood

Enes Salı[1], Solmaz Çelebi[1], Benhur Şirvan Çetin[1], Taylan Çelik[1], Nesrin Özdinç Kızılay[2], Uğur Yakut[2], Muhammed Güneş[2], Mustafa Hacımustafaoğlu[1]

[1]Department of Pediatrics, Division of Pediatric Infection Diseases, Uludağ University Faculty of Medicine, *Bursa, Turkey*

[2]Department of Pediatrics, Uludağ University Faculty of Medicine *Bursa, Turkey*

Abstract

Objective: Deep neck infections are characterized by infections in the potential spaces of the fascial planes of the neck. The objective of the study was to evaluate the characteristics of patients with deep neck infections who were admitted to pediatric infectious disease clinics.

Materials and Methods: The data of patients with deep neck infection was analyzed retrospectively for demographic characteristics, clinical presentation, microbiological and radiological findings, complications, and outcomes between January 2010 and December 2014.

Results: During the study period, a total of 18 patients diagnosed with deep neck infection were followed. Of these, 10 patients (55.6%) were male and the mean age was 84±60.5 months (18–192 months). The most common symptoms at presentation were neck mass (72%) and fever (67%). Three patients (16.6%) had peritonsillar, 7 (39%) had parapharyngeal, 7 (39%) had retropharyngeal, and 1 (5.4%) had parapharyngeal-retropharyngeal infection. Cefotaxime+clindamycin or cefotaxime+clindamycin+gentamicin were the most frequently (78%) used antibiotics. Eleven patients (61%) recovered with only antibiotic treatment. Surgical drainage was performed in 7 patients (39%) who were unresponsive to antibiotic treatment (5 with parapharyngeal, 1 with retropharyngeal, and 1 with peritonsillar abscess). Microorganisms were isolated from 6 (33%) patients' drainage samples. The median length of hospitalization was 14 (7–21) days. The mean duration of antibiotic treatment was 19.3±4.4 days. Acute glomerulonephritis developed in 1 patient with retropharyngeal abscesses. No recurrence/relapse or mortality was observed.

Conclusion: Deep neck infections should be considered in the differential diagnosis of children who present with fever and neck mass. Most patients with deep neck infections can be treated with antibiotics; however, if there is no clinical improvement, surgical drainage must be performed immediately. *(J Pediatr Inf 2015; 9: 114-21)*

Keywords: Deep neck infections, parapharyngeal abscesses, retropharyngeal abscesses, peritonsillar abscesses, childhood

Received: 04.05.2015
Accepted: 04.08.2015

Correspondence Address:
Enes Salı
E-mail:
enessali24@gmail.com

DOI:10.5152/ced.2015.2085

Introduction

Deep neck infections are characterized by cellulite and/or abscess type infections growing in the potential spaces of the fascial planes of the neck (1). These are classified as peritonsiller, parapharyngeal and retropharyngeal infections (2). The most prevalent causes of deep neck infections in children are tonsils and pharyngeal infections, followed by odontogenic infections (3, 4). There are no predisposing reasons in 20-50% of the cases (5). They may cause serious complications if they are not given early diagnosis or appropriate treatment. Mortality rises as high as 50% in cases who develop complications such as airway obstruction, jugular vein thrombosis, mediastinitis, empyema, venous embolism, carotis artery rupture, respiratory distress, septic shock and disseminated intravascular coagulation (5-7).

In this study, demographic characteristics, clinical presentation, microbiological and radiological findings, complications and response to therapy of the patients with deep neck infection were evaluated.

Material and Methods

The records of the patients with deep neck infections admitted to and followed at the

Pediatric Infectious Disease Clinic between January 2010 and December 2014 were retrospectively investigated. Deep neck infection diagnosis was made based on clinical symptoms, physical examination results and neck ultrasonography or contrast-enhanced computerized neck tomography (CT), laboratory test results, or magnetic resonance imaging (MRI) results. Patient stories, physical examination results, laboratory test results and radiological finding were evaluated. Treatments given to the patients, length of treatment, length of hospitalization, existence of surgical operation were examined. Neck contrast-enhanced CT and MRI results were evaluated by pediatric radiology specialist with regards to deep neck infection. Culture samples were taken from the cases with abscess drainage performed and blood culture from all cases. Abscess drainage was added to the aerobe culture medium.

Statistical analysis

Data were evaluated with the SPSS 15.0 package program. Categorical variables were compared with the Fisher's Exact Chi-Square Test. Equally spaced variables or variables with proportional measuring level and non-normally distributed variables were compared with the Mann-Whitney U test; normally distributed variables were compared using the independent sample t-test. $P \leq 0.05$ was accepted as the level of significance.

Results

18 patients diagnosed with deep neck infection admitted and followed within a five-year period at the Pediatric Infectious Disease Clinics between January 2010 and December 2014, were included in this study. The cases that developed submandibuler, submaxillary abscess and cervical lymphadenitis and/or abscess were excluded in the study. 10 (55.6%) cases included in the study were male, 8 (44.4%) female. The mean age of the cases was 84±60.5 months (18-192 months). Table 1 illustrates the demographic characteristics, symptoms and evaluation of clinical findings. The complaints at admission were neck mass (72%), high fever (67%), pain in the neck (44%), limitations in the neck movements (39%) and dysphagia (28%). The mean onset period of the symptoms before admission was 10.1±5.9 (1-21 day) days. We were informed that 94% (17/18) of the patients, who were admitted with the diagnosis of deep neck infection, were treated before at another health center on outpatient basis. The mean oral antibiotic intake period of the cases before admission to our clinic was 7.1±5.3 (1-21 day) days. The main physical examination symptoms before admission were inflammation symptom on the throat (6%1), cervical lymphadenitis (67%), neck mass (72%), limitation in the neck movement (72%), tooth decay (33%), and medial repression in the tonsil/uvula (17%).

Distribution of the infection in the patients based on localizations were; parapharyngeal zone 39%, retropharyngeal zone 39%, peritonsiller zone 16.6% and involvement of parapharyngeal-retropharyngeal zones together 5.4%. Figure 1 illustrates the image of parapharyngeal inflammation. Abscess was found in 7 (39%) cases. As illustrated in Figure 2, there is an inflammation that extends from the left parapharyngeal localization towards the retropharyngeal zone, an image compatible with central cut hypodense abscess showing peripheral contrast involvement on the left parapharyngeal zone. Five of these were parapharyngeal abscesses, one peritonsiller and one another retropharyngeal abscess (Figure 3a, b). It was found that leukocytosis (>10,000/mm^3) was present in 55% of the patients and high CRP levels (>0.5 mg/dL) in 83%. Neck ultrasonography scan was performed in one case with peritonsiller abscess and in two cases with retropharyngeal inflammation. The other cases were given neck CTs or MRI test results. It was found that three of these cases had retropharyngeal inflammation, one peritonsiller inflammation and phlegmon, two patients had parapharyngeal abscess, one had patient retropharyngeal inflammation and parafaringeal apse. Contrast-enhanced neck MRI was performed in eight patients. Of these cases, it was found that three patients had parapharyngeal abscess, three patients had parapharyngeal inflammation, and one patient had peritonsiller abscess and one retropharyngeal abscess. Table 2 illustrates laboratory/imaging findings and treatment results of the patients. All the patients were given intravenous antibiotic treatment on admission. Majority of the patients (78%) were given cefotaxime + clindamycin or cefotaxime + clindamycin + gentamycin intravenously. Despite the antibiotic treatment, due to non-recovery in the clinical findings of the patients and their ongoing high fever, seven patients (39%) were performed surgical drainage by the Department of Ear, Nose and Throat. The surgical drainage was applied on the mean 6.5±5.6 (5-18 day) days of the antibiotic treatment. The patient with peritonsiller abscess was given intraoral procedure, retropharyngeal and pharyngeal cases both intraoral and cervical procedures. Eleven cases (61%) recovered only with the antibiotic treatment.

The patients who were given both antibiotic treatment and performed surgical drainage were compared with the patients who were only given antibiotic treatment (Table 3). The mean antibiotic duration in the patients who were given both antibiotic treatment and performed surgical drainage was 22.7±2.6 days and was significantly longer than group that were only given antibiotics (17.8±4.3 day) (p=0.009). No significant difference was found with

Table 1. Patients' demographic characteristics, symptoms and evaluation of clinical findings

Patient No	Age (Month)/ Gender	Length of symptoms	Symptoms	Clinical findings	Diagnosis
1	48/F	21	Fever	Fever, tonsillary-pharyngitis, cervical LAP	Peritonsiller infection
2	36/F	7	Fever, neck pain, dysphagia, neck movement limitation	Fever, tonsillary-pharyngitis, cervical LAP, neck movement limitation	Parapharyngeal infection
3	94/M	15	Neck mass, neck pain, dysphagia, neck movement limitation	Tonsillary-pharyngitis, neck mass, neck movement limitation, tooth decay	Retropharyngeal infection
4	60/M	7	Swollen neck	Cervical LAP, swollen neck	Peritonsiller infection
5	24/F	7	Fever, swollen neck	Swollen neck	Retropharyngeal infection
6	60/F	5	Fever, swollen neck	Fever, tonsillary-pharyngitis, cervical LAP, swollen neck	Parapharyngeal infection
7	19/M	4	Swollen neck	Cervical LAP, Swollen neck	Parapharyngeal infection
8	94/M	7	Fever, neck pain, dysphagia, swollen neck	Fever, tonsillary-pharyngitis, cervical LAP, swollen neck, tooth decay	Parapharyngeal infection
9	132/M	21	Fever, neck pain,dysphagia, neck movement limitation	Tonsillary-pharyngitis, neck mass, neck movement, tonsil and repression in the tonsil/uvula, tooth decay	Retropharyngeal infection
10	78/F	3	Fever, swollen neck	Fever, tonsillary-pharyngitis, cervical LAP, swollen neck	Parapharyngeal infection
11	192/F	14	Neck pain, dysphagia, swollen neck	Cervical LAP, swollen neck, tooth decay	Parapharyngeal infection
12	192/M	1	Fever, dysphagia, neck movement limitation	Tonsillary-pharyngitis, neck mass, neck movement limitation	Peritonsiller infection
13	144/K	15	Swollen neck	Tonsillary-pharyngitis, cervical LAP, swollen neck, tooth decay	Retropharyngeal infection
14	192/M	7	Fever, swollen neck, neck movement limitation	Fever, swollen neck, neck movement limitation, repression in the tonsil/uvula, tooth decay	Retropharyngeal infection
15	48/M	12	Swollen neck	Tonsillary-pharyngitis, cervical LAP, swollen neck	Parapharyngeal infection
16	18/M	15	Fever, swollen neck	Swollen neck	Parapharyngeal infection
17	48/F	4	Fever, swollen neck, neck movement limitation	Fever, tonsillary-pharyngitis, cervical LAP, neck movement limitation	Parapharyngeal infection
18	42/M	13	Fever, swollen neck, neck movement limitation	Fever, cervical LAP, swollen neck, neck movement limitation, repression in the tonsil/uvula	Parapharyngeal infection

LAP: lymphadenopathy

regards to other clinical findings (p>0.05). Pus was discharged in six of the seven patients performed with a surgical drainage. Pus was unable to be discharged in one case suggesting a phlegmon existence. Microorganism isolated in all of the drainage material (6 cases). *Streptococcus pyogenes* isolated in two cases, *Staphylococcus aureus* in two cases, *Escherichia coli* in one case and *Eikenella corrodens* isolated in one case. No growth occurred in the blood of any patient. It was found that the median length of hospitalization was 14 (7-21 days) days. The mean duration of antibiotics was 19.3±4.4 days. Acute glomerulonephritis developed in one patient with retropharyngeal abscesses. Glomerulonephritis results improved through diuretic and supportive therapies. All the patients were discharged after the oral sequential antibiotic treatment. No recurrence/relapse or mortality was observed in the follow-up.

Discussion

It is reported that prevalence of deep neck infections have decreased in recent years in comparison to previous years due to antibiotic use and improvements in dental care (5, 8). In our study, the results of 18 patients who developed deep neck infection were evaluated. 55.6% of the patients were male; it has been reported in previous studies that deep neck infections in male children are more prevalent (9, 10). In our study, the mean age of the

Table 2. Laboratory/scanning results of the patients and evaluation of treatment results

Patient No	Leucocyte (/mm^3)	CRP (mg/dL)	ESR (mm/hour)	CT/MRI/USG findings	Antibiotic treatment	IV Treatment length (day)	Total length of treatment (day)	Surgical drainage	Abscess culture
1	9080	9.3	24	Neck USG; Peritonsiller abscess	Ampicillin-sulbactam	7	10	-	-
2	12600	11.9	47	Neck MRI; Parapharyngeal inflammation	Cefotaxime+ clindamycin	16	16	-	-
3	4680	2.2	16	Neck CT; Retropharyngeal inflammation	Cefotaxim+ clindamycin	16	21	-	-
4	11610	0.33	13	Neck MRI; Peritonsiller inflammation, abscess	Meropenem+ amikacin	11	23	Yes	*E. coli*
5	8550	0.25	34	Neck CT; Retropharyngeal inflammation	Cefotaxime+ clindamycin+ gentamycin	14	21	-	-
6	11000	9.5	45	Neck CT; Parapharyngeal inflammation, abscess	Cefotaxime+ clindamycin+ gentamycin	12	21	Yes	*S. aureus*
7	22700	13.2	83	Neck MRI; Parapharyngeal abscess	Cefotaxime+ clindamycin+ gentamycin	15	21	Yes	No growth
8	11300	5.3	39	Neck MRI; Parapharyngeal abscess	Cefotaxime+ clindamycin	10	21	Yes	*S. aureus*
9	2940	0.95	87	Neck MRI; Parapharyngeal inflammation, abscess	Cefotaxime+ clindamycin+ gentamycin	14	24	Yes	*Eikenella corrodens*
10	260	19.9	43	Neck MRI; Retropharyngeal inflammation, phlegmon	Cefotaxime+ clindamycin+ gentamycin	14	21	-	-
11	11210	10	41	Neck CT; Parapharyngeal inflammation	Cefotaxime+ clindamycin	8	14	-	-
12	3400	13.2	31	Neck CT; Peritonsiller inflammation, phlegmon	Cefotaxime+ clindamycin	8	14	-	-
13	8300	13.2	30	Neck USG; Retropharyngeal inflammation	Cefotaxime+ clindamycin	14	21	-	-
14	6690	16.1	61	Neck USG; Retropharyngeal inflammation	Cefotaxime+ amikacin	14	21	-	-
15	16590	0.33	2	Neck MRI; Parapharyngeal inflammation	Cefotaxime+ clindamycin	8	14	-	-
16	13100	5.8	15	Neck MRI; Parapharyngeal inflammation, abscess	Meropenem+ gentamycin	21	28	Yes	*S. pyogenes*
17	15400	6.8	45	Neck CT; Retropharyngeal inflammation and parapharyngeal abscess	Cefotaxime+ clindamycin	10	16	-	-
18	38650	15.1	88	Neck CT; Parapharyngeal abscess	Cefotaxime+ clindamycin	14	21	Yes	*S. pyogenes*

MRI: magnetic resonance imaging, CT: computed tomography, USG: ultrasonography, CRP: C-reactive protein, ESR: erythrocyte sedimentation rate

Table 3. Comparison of demographic and clinical data of the patients who were given antibiotic treatment and those who were given antibiotic treatment and surgical drainage performed

Characteristics	Group 1 n=11	Group 2 n=7	p
Median age, [month (min-max)]	78 (24-192)	60 (18-132)	0.246
Gender (n, %)			
Male	4 (36.5)	6 (86)	0.066
Female	7 (63.5)	1 (14)	
Clinical characteristics (n, %)			
Fever	7 (64)	5 (72)	1.000
Pain	5 (46)	3 (43)	1.000
Swelling	7 (64)	6 (86)	0.59
Limited movements	5 (46)	2 (29)	0.637
Dysphagia	4 (36)	1 (14)	0.596
Tonsillary-pharyngitis	8 (73)	3 (43)	0.332
Cervical LAP	7 (64)	5 (72)	1.000
repression in the uvula	1 (9)	2 (29)	0.528
Laboratory results			
Leucocyte (/mm3), median (min-max)	8550 (1050-16590)	11300 (2940-22700)	0.328
CRP (mg/dL), median (min-max)	6.89 (0.19-19.9)	5.6 (0.35-13.2)	0.791
ESR (mm/hour), median (min-max)	34 (2-61)	39 (13-87)	0.791
Infection zone (n, %)			
Peritonsiller	2 (66.6)	1 (33.3)	1.000
Parapharyngeal	2 (29)	5 (71)	0.049
Retropharyngeal	6 (86)	1 (14)	0.151
Parapharyngeal - Retropharyngeal	1 (100)	-	1.000
Length of hospitalization (day), median (min-max)	14 (7-16)	14 (10-21)	0.246
Length of antibiotic usage (day),			
average±SS	17.8±4.3	22.7±2.6	0.009

LAP: Lymphadenopathy; CRP: C - reactive protein; ESR: Erythrocyte sedimentation rate
Group 1: The group that was only given antibiotic treatment; Group 2: The group that was given antibiotic treatment +surgical drainage performed

cases was 84±60.5 months (18-192 months). It was found that the mean age in Belet et al.'s (11) study was 5.6 years, in Tan et al.'s (3) study 5.9 years. Age of the cases in our study was higher than other studies. Diagnosis in deep neck infections is made based on the clinical findings and radiological tests. Clinical findings might be such complaints as neck pains, limitations in neck movements, neck swelling or mass, high fever, trismus, dysphagia, odynophagia and dyspnea (1, 12). In Belet et al.'s (11) study, most frequent complaints on admission were high fever (83%) and neck mass (67%). In their study, Metin et al. (11) reported that most

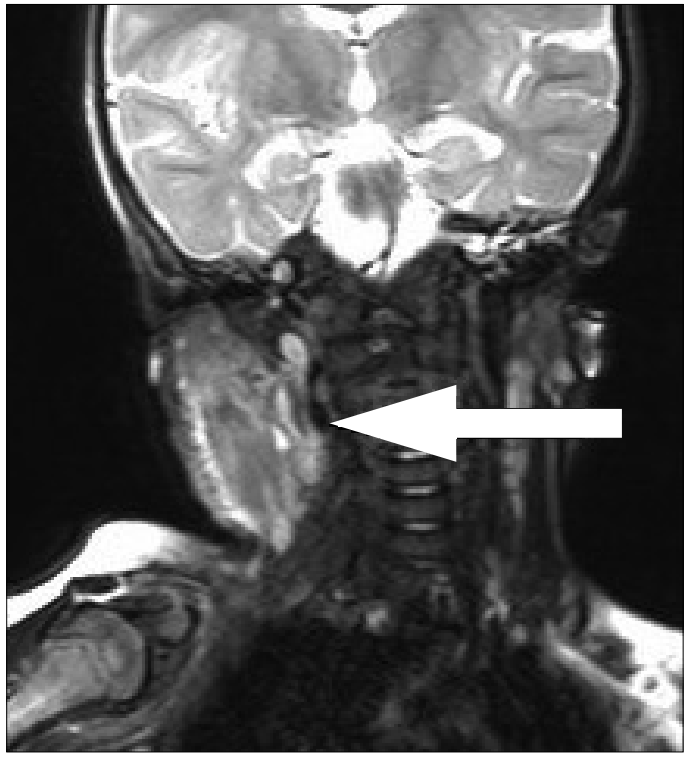

Figure 1. In the contrast-enhanced computerized neck MRI examination, inflammation and parapharyngeal abscess image extending from the right localization towards the deep fascial planes, showing liquefaction necrosis and heterogeneous contrast involvement in the central cut (Patient number 7)

frequent complaints on admission were high fever (100%), neck mass (92%), limitations in neck movements (40%), odynophagia (40%) and dyspnea (24%). The complaints on admission in our study were neck mass (72%), high fever (67%), pain in the neck (44%), limitations in neck movements (39%) and dysphagia (%28); although their percentages change, they are similar to the ones in the literature. The following are the percentages of the physical examination findings obtained in our study; inflammation in the throat finding (61%), cervical lymphadenitis (67%), neck mass (72%), limitations in neck movements (72%), tooth decay (33%), medial repression in the tonsil/uvula (17%). It was found in our study that the mean hospital admission upon the onset of symptoms in our cases was 10.1±5.9 days and the mean oral antibiotic intake before hospitalization was 7.1±5.3 days. It was reported in previous studies that the mean hospital admission upon the onset of symptoms was 5.9 and 5.2±5.3 days (3, 9). The length of symptoms in our study was longer than previous studies; all the patients except one case were given oral antibiotic treatment on admission. This particular result made us think that our hospital was tertiary healthcare service, the participating patients primarily presented with primary care hospitals and they were referred to our hospital as they were non-responsive to the treatment.

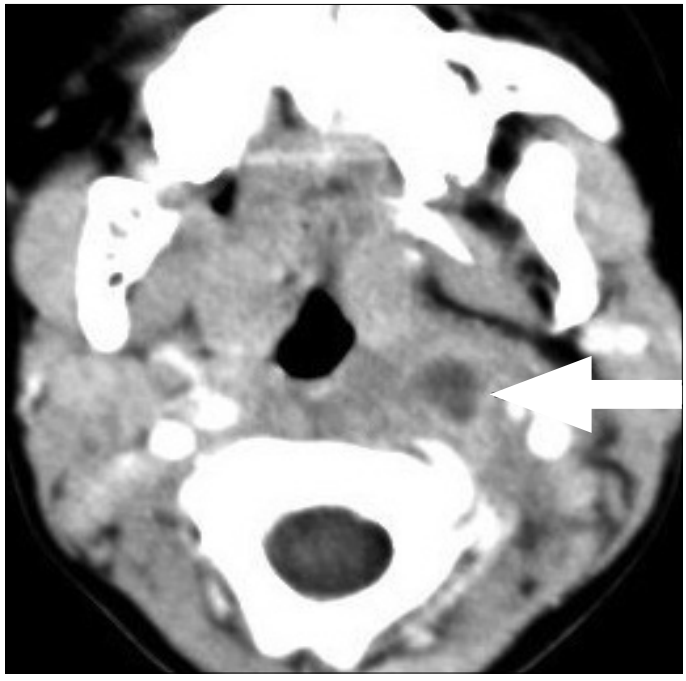

Figure 2. In the contrast-enhanced computerized neck MRI examination, there is an inflammation extending from the left parapharyngeal localization to the retropharyngeal zone, the image compatible with central cut hypodense abscess showing peripheral contrast involvement on the left parapharyngeal zone (Patient number 17)

Leukocyte count and CRP value are important in diagnosis of deep neck infections (9, 13). In Belet et al.'s (11) study, it was found that leucocytosis was 67%, CRP elevation was found in all cases. In our study, it was found that 55% of the patients had leucocytosis and 83% had high level of CRP. In the infection diagnosis of the neck contrast-enhanced CT, susceptibility was reported to be 95%, specificity 53% (14). For diagnosis, a CT scan was performed in 7 patients, and MRI in eight patients. In our study, it was found that the most prevalent infections were parapharyngeal (39%) and retropharyngeal (39%) followed by peritonsiller (16.6%) infection. In their study in which Tan et al. (3) evaluated 68 children with deep neck infection, they found that the most prevalent infection was retropharyngeal (36.7%), followed by parapharyngeal (30.8%), peritonsiller (20.6%) and in more than one zone (12%). The distribution of infection zones in our study was compatible with the literature. Retropharyngeal and parapharyngeal abcesses are mostly seen in children since lymph nodes are noticeable; peritonsiller abscess is frequently seen in older children who have *S.pyogenes*-driven throat infection (15). In our patients, on the other hand, no difference emerged in age-based infection distribution.

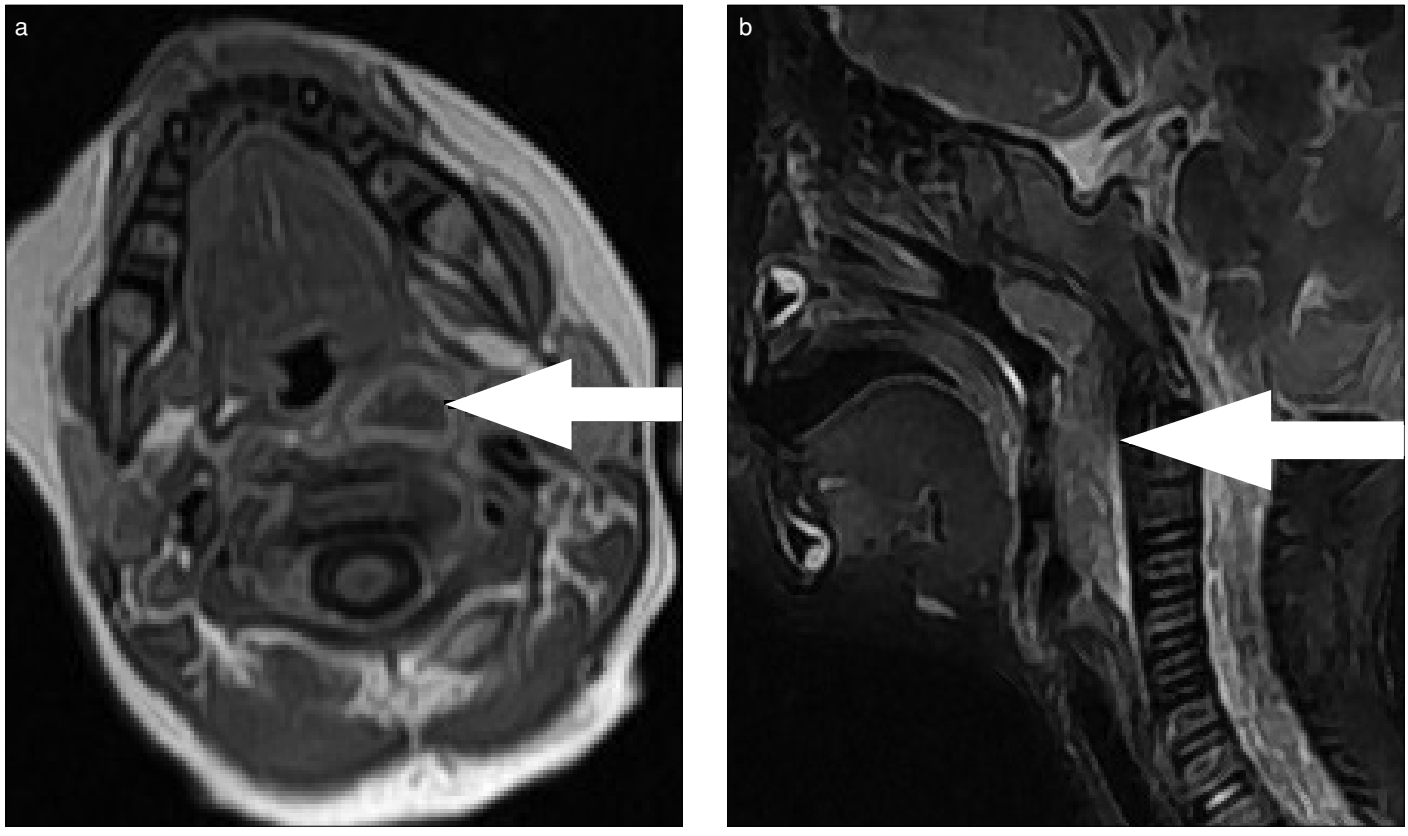

Figure 3. a, b. (a) In the contrast-enhanced computerized neck MRI examination, the image compatible with peripheral contrast involvement on the left retropharyngeal zone (Patient number 9) (b) In the contrast-enhanced computerized neck MRI examination, the image of sagittal incision, thickening in the soft tissue in the retropharyngeal zone and inflammation (Patient number 9)

In pediatric studies, the most frequent cause of deep neck infections are reported to be acute respiratory tract infections followed by decayed tooth-driven infections (9, 13). Tom et al. (16) found tooth decay in 29% of the cases with deep neck abscess. In a study done with school age children in Turkey, tooth decay rate was 50.1% in school age children aged 5-17 (17). In our study, eleven patents (61%) were found to have tonsillary- pharyngitis and six cases (33%) tooth decay. Aerobe and anaerobe bacteria mostly cause the deep neck abscesses. *S.pyogenes*, *S. aureus*, *Haemophilus influenzae*, *Bacteroides*, *Prevotella*, *Fusabacterium* ve *Peptostreptococcus* types have a role to play in the etiology (9, 11, 13, 18). Abscess drainage material should be planted in the aerobic and anaerobic culture medium. In our study, it was found that in the abscess drainage material culture, two cases had *S. aureus*, two cases *S. pyogenes*, one case *E. coli* and one case had *E. corrodens* growth. *S. aureus* strains were methysticine–sensitive. *E. corrodens* was gram negative facultative anaerobe bacillus and was isolated from the drainage material of the case (case number 9) with retropharyngeal abscess and tooth decay.

Systemic antibiotic treatment is recommended in deep neck infections. Frequently in the cellulite and phlegmon period, improvement occurs with the antibiotic treatment. In the case of abscess which is non-responsive to antibiotic treatment, surgical drainage is required (18). In our study, 61% of the cases improved with antibiotic treatment; seven cases (39%) with abscess were applied surgical drainage. In Belet et al.'s (11) study, they found that rate of improvement only with antibiotic was 83% and in Metin et al.'s (13) study was 64%. In the primary care treatment, 3rd generation cephalosporin alone or combined with metronidazole are recommended. In the Methicillin-resistant S.aureus strains, glycopeptide indication exists. Carbapenems are recommended in serious cases caused by extended β lactamase positive gram negative organisms (18). Our cases were frequently given combined cefotaxime and clindamycin treatment. Isolated *S.aureus* strains were methicillin-sensitive. The mean antibiotic usage length in cases with surgical drainage performed was 22.7±2.6 days; it was significantly longer than the group (17.8±4.3 days) that was given antibiotic (p=0.009). In their study, Raffaldi et al. (18) found that the length of antibiotic usage in the group that was given antibiotics was 8.5±4.1 days; the length of antibiotic usage in the group that was given antibiotics and surgery performed was 12.7±4.3 days, and statistically significant difference was found (p=0.0003). We are of the opinion that the length of the antibiotic usage in our study, as compatible with the literature, is related with the fact that the surgery-performed patients' disease is more serious. In deep neck infections, complications such as airway obstruction, jugular vein thrombosis, mediastinitis, empyema, venous emboli, carotid artery rupture, respiratory distress, septic shock and disseminated intravascular coagulopathy may develop (5-7). In one case with retropharyngeal abscess, acute glomerulonephritis developed, then the patient was given diuretic treatment, and when the glomerulonephritis findings improved, the patient was discharged. Previous studies reported that mortality rate in deep neck infections was 2-16% (19-21). Early diagnosis and appropriate treatment reduce mortality. No mortality occurred in our study.

Conclusion

In the deferential diagnosis, deep neck infections should be kept in mind in children admitted with high fever and neck swelling or mass. Systemic antibiotic treatment should be started. We are of the opinion that the patients who are non-responsive to the antibiotic treatment and/or develop abscess require surgical drainage.

Ethics Committee Approval: Ethics committee approval was not received due to the retrospective nature of this study.

Informed Consent: Ethics committee approval was not received due to the retrospective nature of this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - E.S., S.Ç.; Design - B.Ş.Ç., T.Ç., M.H.; Supervision - S.Ç., M.H.; Data Collection and/or Processing- N.Ö.K., U.Y., M.G.; Analysis and/or Interpretation - E.S., S.Ç.; Literature Review - E.S., S.Ç.; Writing - E.S., S.Ç.; Critical Review-M.H.; Other - E.S., S.Ç.

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

Financial Disclosure: The authors declared that this study has received no financial support.

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