Original Article

Prevalence of Odontogenic Deep Head and Neck Spaces Infection and its Correlation with Length of Hospital Stay

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ABSTRACT

Statement of Problem: As the duration of hospital stay could be an indicator of the severity of infection (Including odontogenic sources); defining related variables could be very helpful in the treatment process. All clinical and paraclinical variables related to sever head and neck infections of odontogenic origin have not been fully evaluated.

Purpose: This study was designed to identify the potential risk factors associated with increasing hospital stay in patients with deep head and neck spaces infections of odontogenic origin.

Materials and Method: A total of 297 patients admitted to Shiraz Khalili hospital (1996-2006) with head and neck spaces infection were retrospectively identified by a medical chart view. Data concerning patient demographics, source and location of infection, culture results, and treatment modalities were evaluated. Linear regression techniques were used to explain the relationship between patient admission characteristics and duration of hospitalization.

Results: A total of 34.3 % (n=102) of the patients had head and neck spaces infections of odontogenic origin. The most common location of infection was submandibular space (32%), followed by masseter space (22%) and Ludwig's angina (20%). Culture results showed non-hemolytic streptococcus as the most common microorganism with the prevalence of 61.6%.The most frequent signs and symptoms were swelling and pain. The results showed a higher percentage of hospital admissions for the middle socioeconomic status (58.8%). Variables such as high weight, blood sodium level less than 135, preexisting disease and increasing in blood mean cell volume (MCV) were associated with longer hospital stay. Only 1 (0.9%) death was reported as the result of these infections.

Conclusion: Odontogenic infections were a common source of deep head and neck spaces infection resulted in longer hospital stay. Paying particular attention to the variables that lead to longer hospital stay could be very important in formulating the treatment plan and reducing complications.

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Introduction

The most common primary sources of deep neck infections are the dentition, tonsils, salivary glands, foreign bodies, and malignancy. Infections originating from teeth or their supporting structures known as odontogenic infections have been one of the most common diseases in the oral and maxillofacial region [1] especially in developing countries [2]. Although most of them respond to modern treatments, and are usually spatially confined, some may propagate to

vital structures or overcome the host defensive system, leading to patient's death.

Common and potentially life-threatening complications include airway obstruction, jugular vein thrombosis, descending mediastinitis, sepsis, acute respiratory distress syndrome, disseminated intravascular coagulation [3], pleuropulmonary suppuration and hematogenous dissemination to distant organs [4].

Prevention of odontogenic infections includes all aspects of dental care including tooth caries, pulpal and periodontal diseases, pathologic conditions, trauma and restorative surgeries and implants. Treatment of odontogenic infections is mainly surgical aiming at removal of the source. Root canal therapy, dental extractions and incision and drainage of infected spaces are usually supported by antibiotics and other measures to improve patient defense [5].

Two basic cause of odontogenic infections are: 1. Periapical lesions with pulp necrosis and bacterial invasion into periapical tissues 2. Periodontal lesions associated with periodontal pockets. The former is more common in odontogenic infections [5].

Pulp necrosis as the result of deep tooth caries promotes bacterial leakage to periapical tissues. When the periapical tissue is invaded by bacteria, an active infection will occur. The infection expands thoroughly in all directions, but it has minimum expansion in pathways with the most resistance. Infection invades the spongy bone until it reaches the cortical plate. If the cortical plate is thin, the infection passes through it and after crossing periosteal layer, enters soft tissue. The exact location of the infection in soft tissue is determined by the connection between the muscle and the bone which causes the infection to manifest as vestibular abscess or involvement of primary mandibular or maxillary spaces, and finally infections can extend from primary spaces (submental, submandibular, buccal, sublingual, canine and…) to other facial spaces known as secondary spaces [5].

Anatomical spaces and fascias of head and neck area are connected and any odontogenic infection that reaches these anatomical spaces may cause an upward spread to the brain which may result in brain abscess, cavernous sinus thrombosis and meningitis, or a downward spread which may cause mediastinis or pericardiatis [6], all of these could be fatal so prevention and prompt management is very critical. Severity of the infection and occurrence of complications lead to longer hospital stay so determination of related variables could be crucial in early diagnosis and treatment.

This retrospective study reviewed cases with deep head and neck space infections of odontogenic origin who admitted to Khalili hospital, Shiraz, IRAN. The aim of this study was to identify odontogenic infections and the potential risk factors associated with increasing hospital stay in patients with deep head and neck space infections.

Materials and Method

A total of 297 cases were reviewed from a group of patients admitted to Shiraz Khalili hospital from 1996 to 2006 due to head and neck space infections. The review resulted in a group of 102 cases identified with odontogenic infection**.** These cases were evaluated based on geographical location and socioeconomic status. They were classified into three groups according to their addresses in their files: 1) Urban region of high socioeconomic status 2) Urban region of middle socioeconomic status 3) Suburban region of low socioeconomic status. Among all 102 cases, 3 (2.9%) were classified to the first group; 60 (58.8%) to the second group; and 39 (38.2%) to the third group.

The following study variables were also identified from the patients' medical records: age, sex, weight, blood pressure, source of infection, site of deep head and neck infection, duration of hospitalization, systemic diseases, drug abuse, evidence of constitutional sign & symptoms (fever, malaise), cell blood count (CBC), serum sodium level, fasting blood sugar (FBS), bacteriology results and treatment modalities (antibiotic and operative therapy). Statistically linear regression techniques were used to explain the relationship between patient admission characteristics and duration of hospitalization.

Results

Our results showed odontogenic infections as the most common source of hospitalization due to head and neck infections (34.3%). According to the registered files and reported cases, the most occurrence of infection was in submandibular space (32%) followed by masseteric space (22%), and Ludwig's Angina (20%)

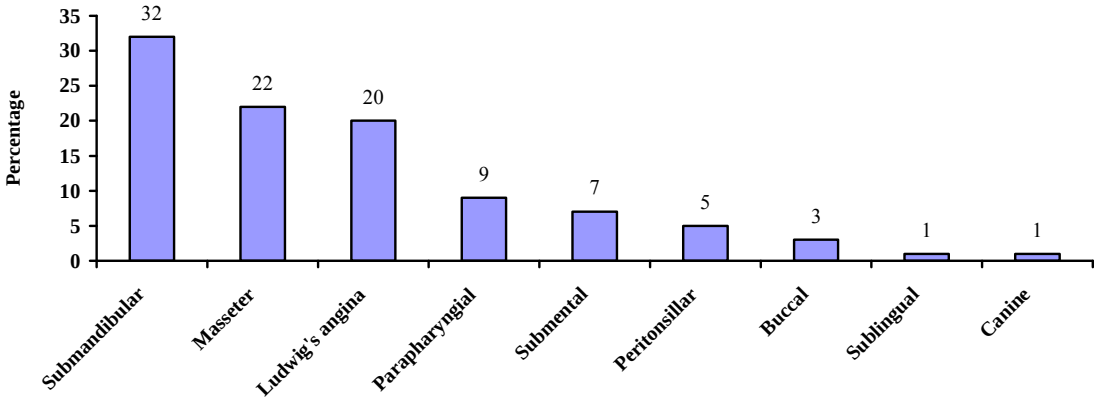

Figure 1 Head and neck infections of odontogenic origin by anatomical location in patients

(Figure 1). FBS test was obtained in 65 cases. The results showed that 26 patients (40%) had higher than normal levels. Also, blood pressure levels of 6.9% patients were higher than normal range (More than 140/90).

Among 102 hospitalized cases, 11(10.8%) of had previous history of drug abuse. The average hospital stay in non-addicts was 5.6 days and in addicts was 6.5 days. Patients with peritonsillar space infection of odontogenic origin had the highest mean age of 47 years and cases with masseteric space infection had the lowest mean age of 27 years.

Cases with peritonsillar space infection had the longest average hospital stay (6.6 days) and cases with masseter space involvement had the least average hospital stay (4.42 days).

The admission white blood cell count (WBC) in 92 patients was recorded. The results showed 27 (29.3%) cases with a WBC count of over 15400. Fifty nine patients with recorded serum sodium level counts were evaluated and 14 (23.7%) had values of less than 135. We also found that increase in MCV volume was directly proportional to the duration of hospital stay.

According to the present study, it was found that average hospital stay in patients with systemic diseases such as diabetes (6.6 days) was more than healthy people (5.5 days). Also duration of hospital stay was directly proportional to the patient's weight.

The results of bacterial culture were available only in 13 cases. The most frequent micro organism was non-hemolytic streptococcus (61.6%), followed by α-Hemolytic Streptococcus (46.2%) and Enterobacteria (7.7%). All of the micro organisms were aerobic. The most common signs and symptoms were swelling (n=96; 95%) and pain (n=73; 72.2%) (figure 2). Penicillin (67.7%) was the most prescribed antibiotic; Followed by metronidazole (65.2%) and clindamycin (37.7%) (Figure 3).

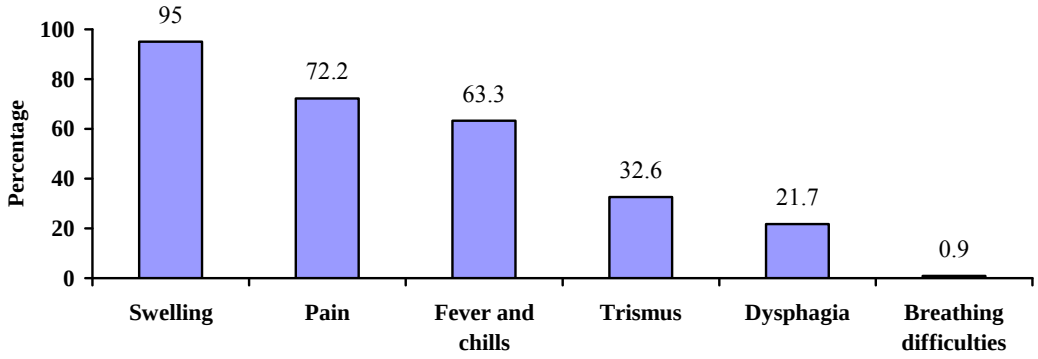

Figure 2 Signs and symptoms of Patients with odontogenic deep head and neck infections

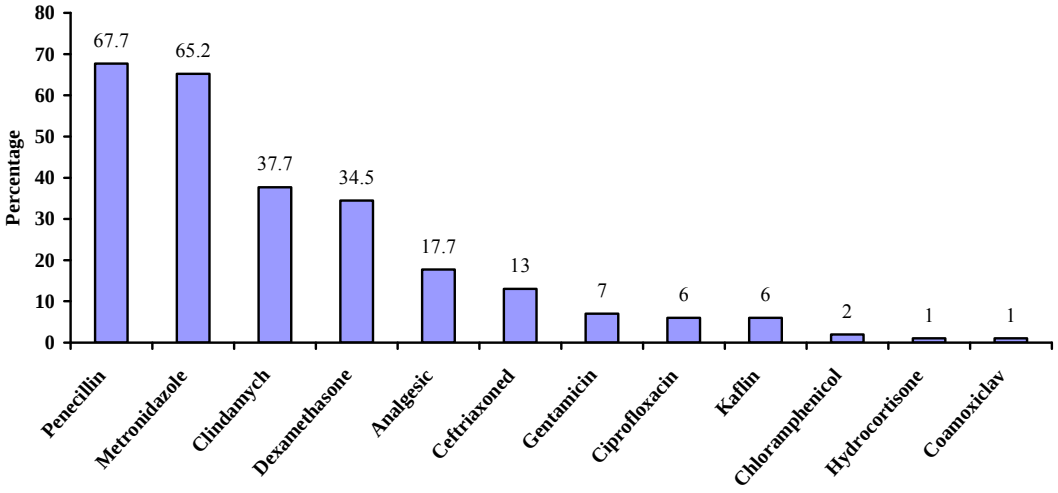

Figure 3 Antibiotic and drug therapy for the patients with odontogenic deep head and neck infections admitted to Khalili Hospital in years 1996 to 2006

In this study, the effect of antibiotic usage on the duration of hospital stay was evaluated in patients who received or did not receive the medication and the results were concluded as stated below.

Penicillin: according to the *t*-test (p =0.025), 68 cases who received this drug, had longer hospital stays (6.18 days) than the 32 cases who did not (5 days).

Metronidazole: t-test results did not show any statistically significant difference between the two groups. Sixty six consumers of this drug had longer hospital stay (5.5 days) compared with 34 non-consumers (4.4 days).

Ceftriaxone: Mean hospitalization in consumers of this drug was 7.7 days and in non-consumers was 5.51 days (p =0.002).

Clindamycin: Mean hospital stay in consumers of this drug was 5.18 days and in non-consumers was 6.18 days (p =0.049).

Gentamicin: Mean hospitalization in consumers of this drug was 7.9 days and in non-consumers was 5.6 days (p =0.028).

The mortality rate associated with head and neck spaces infection of odontogenic origin was reported at 0.9% (1 case), which was due to Ludwig's Angina.

Discussion

Evaluation of variables related to life-threatening diseases is of outmost importance. In this study we found that the most common source of deep head & neck infections is the dentition. Length of hospitalization as an indicator of severity of infection was related to the following factors: socioeconomic status, weight, blood pressure, blood sugar level, White Blood Counts (WBC), Hemoglobin (HB) level, Mean Capsular Volume (MCV) & serum sodium.

Based on a study by Tschiassny et al. [7] in 1944, 70% of deep neck infections were odontogenic in origin. In retrospective study of Parhiscar et al. [8] odontogenic infections were declared as the most important causes of deep neck infections (43%). Bottin et al. [9] showed the same results as in Parhiscar study. 42% of patients had deep neck infections with odontogenic origin. In the study performed by Lee et al. [10] in 2007, only 3.8% of the patients who were diagnosed with deep neck infection, presented with pharyngotonsillar sites of origin. The study found the most common cause to be dental infections (12%). This may be due to the delay of treatment caused by the relatively high cost of dental care and public indifference to dental health compared with pharyngotonsillitis.

In our study, 34.3% of head and neck infections had odontogenic origin which resulted in hospitalization and consequently, 31.9% of cases had undergone surgical process. This high percentage of hospital referral, describes that in our society more attention

needs to be paid to the oral hygiene and prevention of infection to reduce the risk of head and neck spaces infection of odontogenic origin, which would cause unpleasant outcomes such as hospitalization and going under surgical process.

Of the 102 reviewed cases with head and neck spaces infection of odontogenic origin, 60 (58.8%) cases were males and 42 (41.18%) were females. This may indicate that men pay less attention to their oral hygiene than women and do not go to dental office regularly because of their preoccupations.

Based on Tartter study [11], patient's age was proportional to hospital length of stay. The overall chance of dental infection reduces by age since there are fewer teeth present in the oral cavity. According to Rega [12], the average age for reviewed cases, was 33 years and there was no significant difference between the mean age of men and women. The results were similar in other studies. Our study showed the lowest infection occurrence in sixth, seventh, and eighth decades. This is in agreement with Tartter's findings. With age increasing, occurrence rate of infection was reduced. In the present study, the mean age of patients was 33.8 years without any significant difference between men and women. Our results were similar to the results of Rega study.

The results showed 3 (2.9%) cases from the total patients lived in area of high socioeconomic status of Shiraz. 60 (58.8%) cases were residents of area of middle socioeconomic status and 39 (38.2%) cases habited in suburbs. These results show a higher percentage of hospital admissions for the middle socioeconomic status. Lower socioeconomic status areas of the city's suburbs showed fewer admissions probably due to difficulties of access to care or transportation issues.

According to Parhiscar et al. [8] parapharyngeal space had the most involvement (43%), followed by submandibular space (27%) and Ludwig's angina (17%). Meher et al. [13] reviewed 54 cases with deep neck abscess and listed submandibular space (37%) as the most common location of spaces infection, followed by submental space. Rega et al. [12] reported submandibular space as the most frequent space involvement (30%), followed by buccal (27.5%) and lateral pharyngeal space (12.5%). We had the most frequent involvement in submandibular space (32%) which was similar to Meher and Rega; and the second most common location was masseter space (22%), followed by Ludwig's angina (20%) approximately similar to parhiscar study.

The root apex proximity of mandibular molars to submandibular space was the reason for the majority of infection involvement. We concluded that mandibular molars were the most frequent teeth involved in deep head & neck odontogenic infections. This conclusion was already made by Umeda et al. [14]. (The most common cause of head and neck infections with odontogenic origin was associated with mandibular molars (66.6%).)

Daramola et al. [15] evaluated patients with deep neck space abscesses between 2001 and 2006. Dental infections were the most common cause (49.1%). Comorbidities included substance abuse (53.7%), psychiatric illness (10.4%), hypertension (9.4%), head and neck cancer (6.6%), and diabetes mellitus (5.7%)

Umeda et al. [14] reviewed the systemic conditions and other risk factors of odontogenic infections. According to their study, the most frequent risk factor was diabetes, which was reported in 31 (24.8%) cases, followed by alcohol abuse in 21 (16.8%); tobacco abuse in 149 (12.2%), and hypertension in 14 (12.2%). In our results, 40% of cases presented higher than normal FBS level. 6.9% of patients showed hypertension, and 10.8% had previous history of drug abuse. We concluded that the most common risk factor in our study was diabetes, similar to Umeda et al., followed by drug abuse and hypertension. In diabetics, proper function of macrophages is compromised [16]. In drug addicts, poor blood circulation causes spread of infection.

In a retrospective study by Srivanitchapoom C et al. [17] 177 patients with deep neck infection, excluding peritonsillar abscess, were reviewed. 87 patients who presented with multiple space involvement were evaluated in terms of white blood cell count (<5,000 or >12,000/µl). Complications were affected by both host immunity and abnormal Hb level (<10 or >15 g/dl). Consequently, blood tests (WBC and Hb levels) were the most important investigations necessary in patients suspected of having multiple space involvement and complications. Wall et al. [18] described that the patients were predisposed to

necrotizing infections if their WBC count was more than 15400 and their blood sodium level count was less than 135. In present study, of 59 patients with recorded sodium level count, 14(23.7%) had sodium level count of less than 135. According to the longer hospital stay in these patients, reduction of blood sodium level could be a co-factor for delaying recovery from infect-ions which needs additional investigations. We also realized that MCV volume and patients' weights were directly proportional to duration of hospitalization.

Peritonsillar space infection (of odontogenic origin) occurs in older ages, and the mean hospital stay is longer possibly due to decrease in host immune system. In contrast, masseter space infections were more prevalent in younger people.

According to Meher et al. [13] pain was the most common presenting symptom, followed by fever and dysphagia. Neck stiffness and trismus was present in eight patients. According to Bottin et al. [9] the most common signs and symptoms were neck swelling and pain. In the present study, the most frequent sign was swelling which was found in 95% of patients. The other signs and symptoms in order of prevalence were: pain, fever and chills, trismus, dysphagia and breathing difficulties.

In the study performed by Roman et al. in 1980, Penicillin was described as the most commonly used antibiotic in treatment of deep head and neck infections of odontogenic origin which was used in 75% of patients. Edward et al. described penicillin as the most commonly used antibiotic, followed by Clindamycin. Based on our study, Penicillin (67.7%) was the most commonly used antibiotic followed by Metronidazole (65.2%) and Clindamycin (37.2%). The results show that we still have the same old routine for antibiotic therapy in dental infections. The patients, who were treated with Clindamycin, had shorter hospital stay, in contrast with using other antibiotics (Penicillin, Ceftriaxone, Metronidazole and Gentamicin).

Patients with single space involvement had shorter hospital stay than patients with involvement of multiple spaces. The mean hospital stay of patients with systemic conditions was more than healthy cases. Length of stay in patients who underwent surgical process was 5.8 days and the least length of stay was 48 hours, similar to Peter study [19].

Concerning limitations of the present study, several points should be noted. There is not a uniform pattern for patient referral to hospitals in a geographic area. Lack of standard medical charts and documentation techniques are other important interfering variables. Lastly anaerobic bacterial cultures were not performed for the cases routinely.

Conclusion

Odontogenic infections were the most common source of head and neck infections (34.3%). The most frequent site of involvement was submandibular space.

Complications of deep head and neck spaces infection are still potentially fatal, and that is why we recommend that high-risk groups, such as diabetic and obese patients and/or patients with more than two involved spaces, should be more closely observed throughout their hospitalization. Also laboratory findings such as FBS, WBC, Hb & serum sodium should be closely monitored in deep head & neck infections. Consequently, the role of dentist to prevent the spread of the infections is very important. In our society more attention needs to be paid to physical health and oral hygiene specially in middle and low socioeconomic groups. Further investigations to clarify factors and variables related to deep and potentially fatal head and neck infections are necessary.

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