J Istanbul Univ Fac Dent 2015;49(2):17-22.
http://dx.doi.org/10.17096/jiufd.90557

ORIGINAL RESEARCH

GENERAL APPROACH TO THE TREATMENT OF ODONTOGENIC ABSCESSES AND COST ANALYSIS

Odontojen Kökenli Apselerin Tedavisinde Genel Yaklaşım ve Maliyet Değerlendirmesi

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Received: 11/09/2014
Accepted:21/01/2015

ABSTRACT

Purpose: *The purpose of this study was to evaluate the relationships between age, gender, symptoms, treatment, length of hospital stay and hospital cost in a group of patients with severe odontogenic infection who has been admitted within the last 6 years.*
Subjects and Methods: *This study was carried out on 30 patients who had been treated in Ege University, Faculty of Medicine, Otolaryngology Department with the diagnosis of odontogenic abscess. Variables such as age, gender, symptoms, systemic disease, imaging techniques, treatment modalities, hospital length of stay and hospital cost were analyzed statistically.*
Results: *There were 12 female and 18 male patients and their mean age was 39 ± 19.78 years. Antibiotics were used in all subjects and their abscesses were mostly drained surgically. The mean hospital length of stay was 8.1 days. There was a statistically significant relationship with the presence of systemic disease and hospital length of stay variables (p=0.017).*
Conclusion: *The cost for treatment of severe odontogenic infections in inpatient units is high in hospitals. Therefore, preventive and routine dental care should be given importance.*

Keywords: *Abscess; odontogenic infection; hospital length of stay; treatment cost*

ÖZ

Amaç: *Bu çalışmanın amacı, çene ve yüz bölgesinde ciddi odontojen kökenli enfeksiyon nedeniyle 6 yıllık sürede başvuran hastaların yaş, cinsiyet, semptomlar, tedavi, hastanede kalış süreleri ve hastane maliyetleri değişkenleri arasındaki ilişkilerin değerlendirilmesidir.*
Bireyler ve Yöntem: *Çalışma, odontojen kökenli apse nedeniyle Ege Üniversitesi, Tıp Fakültesi Kulak Burun Boğaz Anabilim Dalı'na başvurmuş toplam 30 hastanın verileri incelenerek hazırlandı. Yaş, cinsiyet, semptomlar,sistemik hastalıklar, görüntüleme yöntemleri, tedavi şekilleri, hastanede kalış süreleri ve maliyet gibi veriler kaydedilerek istatistiksel olarak değerlendirildi.*
Bulgular: *Hastalar 12 kadın ve 18 erkek bireylerden oluşuyordu. Yaş ortalaması 39 ± 19.78 olarak tespit edildi. Tedavi olarak tüm hastalarda antibiyotik kullanılırken cerrahi olarak genellikle apse drenajı yapıldı. Hastaların yataklı serviste kalış süresi 8.1 gün olarak saptandı. Sistemik hastalık varlığına göre hastanede kalma süresi arasında anlamlı bir fark olduğu görüldü (p=0.017).*
Sonuç: *Ciddi odontojenik enfeksiyonların tedavisi için hastanelerin yataklı birimlerinde tedavi yüksek bir maliyet oluşturmaktadır. Bu nedenlerle, koruyucu hekimlik ve rutin dental bakıma gereken önem verilmelidir.*

Anahtar kelimeler: *Apse; odontojenik; hastanede kalma süresi; hastane maliyeti*

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Introduction

Most infections occurring in the maxillofacial region are of odontogenic origin. Such infections should be treated medically and surgically in the hospital settings in outpatient clinics or, for complicated cases, in inpatient units. Inadequate or late treatment of odontogenic infections would usually cause airway obstruction that includes mediastinum and spinal column, as well as serious complications such as visual impairment related to the cavernous sinus thrombosis and sepsis (1). Complex treatment procedures that require prolonged hospital length of stay in inpatient units can lead to higher costs. Important odontogenic infections present significant health risk for patients and place considerable financial burden on health care system. The aim of this study is to evaluate the relationships between age, gender, symptoms, treatment, length of hospital stay and hospital cost in a group of patients with severe odontogenic infection who has been admitted to Ege University, Faculty of Medicine, Department of Otolaryngology within the last six years.

Subjects and Methods

Population Characteristics

This study has been done by reviewing retrospective chart data from 30 patients (18 male, 12 female) who had been admitted to Ege University, Faculty of Medicine, Department of Otolaryngology with complaints of pain, swelling and trismus of odontogenic origin in the maxillofacial region. Patients who had stayed for at least 1 day in inpatient unit were included in the study. Patients who had outpatient care for less than 1 day were not enrolled. Data such as age, gender, swelling, trismus, dysphagia, leukocytosis, fever, microbiological culture, antibiotic use, presence of systemic disease, imaging modalities, hospital length of stay and treatment cost were evaluated.

Statistical analysis

All data analyses were performed using Statictical Package for Social Sciences (SPSS) 15.0 (SPSS Inc., Chicago, IL, USA) for Windows.The differences between central tendencies of hospital length of stay and cost variables were evaluated with Kruskal-Wallis H test according to the systemic disease variable. Same calculations for dysphagia, trismus, leukocytosis and fever variables were done using independent samples t-test. Confidence interval was set to 95% and two tailed p values less than 0.05 were considered statistically significant.

Results

Retrospective chart data from 30 patients (18 male, 12 female) who met study inclusion criteria were reviewed. Their mean age was found to be 39. Pain and swelling symptoms were present in all cases. Trismus was observed in 17 patients (56.7%) and 9 participants had dysphagia. 11 patients (36.7%) showed laboratory findings consistent with leukocytosis. 21 participants had fever symptom. Mean level of blood glucose was 114.6 mg/dl. According to their medical history, 2 patients had been previously diagnosed with only diabetes mellitus type 2 and 3 participants with organ insufficiency and diabetes mellitus type 2. Remaining patients had no history of systemic disease. 18 patients reported that they have previously received antibiotic theraphy before admitting to the Department of Otolaryngology. Remaining patients did not report any kind of treatment. 2 magnetic resonance imaging (MRI), 15 computed tomography (CT), 1 diagnostic ultrasound imaging (USG), 7 MRI + CT were obtained. No diagnostic imaging was performed in 5 patients. Antibiogram was done in 8 cases before treatment. Sultamicillin was given to 15 patients, sultamicillin + metronidazole to 1 patient, clindamycin to 2 patients, cylindamycin + trimethoprim to 1 patient, ceftriaxone to 1 patient, ceftriaxone + metronidazole to 7 patients, teikoplanin to 1 patient, potassium clavulanic acid to 1 patient and potassium clavulanic acid + metronidazole to 1 patients. Surgical procedures included 15 abcess drainage under local anesthesia, 1 biopsy, 2 abcess drainage and 1 extraction under general anesthesia. 11 patients were only treated with antibotics. Mean length of hospital stay was calculated as 8.1 days. Mean treatment cost per patient was 748.35 Turkish Lira. There was no statistical difference between mean ages with respect to the presence of trismus symptom (p=0.971). Age distribution did not differ with respect to the presence of dysphagia (p=0.128). However, difference between the means of hospital length of stay with respect to the presence of dysphagia symptom was found to be statistically significant (p=0.041). No statistically significant difference was found in the hospital length of stay with respect to the presence of trismus (p=0.540). The differences between the means of hospital length of stay with respect to presence of leukocytosis (p=0.421) and fever (p=0.885) symptoms were not significant (Table 1).No statistically significant difference was found in the hospital length of stay with respect to the presence of systemic disease (p=0.404) (Table 2). There was no statistically significant difference in the mean cost per patient with respect to the presence of systemic disease (Table 3).

Table 1. *Independent samples t test for study variables (SD: standard deviation).*

Trismus	**Mean age (years)**	**age SD**	**t**	**p**
Present	39.12	20.46	0.037	0.971
Absent	38.85	19.68		
Dysphagia	**Mean age (years)**	**age SD**	**t**	**p**
Present	30.56	15.32	-1.569	0.128
Absent	42.62	20.68		
Dysphagia	**Mean length of hospital stay (days)**	**SD**	**t**	**p**
Present	9.22	5.98	0.781	**0.041**
Absent	7.62	4.78		
Trismus	**Mean length of hospital stay (days)**	**SD**	**t**	**p**
Present	7.59	4.09	0.620	0.540
Absent	8.77	6.33		
Leukocytosis	**Mean length of hospital stay (days)**	**SD**	**t**	**p**
Present	7.09	2.74	0.817	0.421
Absent	8.68	6.08		
Fever	**Mean length of hospital stay (days)**	**SD**	**t**	**p**
Present	8.19	5.35	-0.145	0.885
Absent	7.89	4.81		

Table 2. *Hospital length of stay in the presence of systemic disease (SD: standard deviation).*

Systemic disease	**Mean length of hospital stay (days)**	**SD**	**Kruskall-Wallis H**	**p**
Absent	6.68	2.72	2.920	0.404
Diabetes mellitus type 2	14.50	13.44		
Organ insufficiency	8.00	4.58		
Diabetes mellitus type 2 and Organ insufficiency	14.33	8.33		

Table 3. *Mean treatment cost per patient in the presence of systemic disease (TL: Turkish Lira, SD: standard deviation).*

Systemic disease	**Mean cost (TL)**	**SD**	**Kruskall-Wallis H**	**p**
Absent	621.97	465.28	2.392	0.495
Diabetes mellitus type2	1907.05	2155.45		
Organ insufficiency	887.95	328.93		
Diabetes mellitus type 2 and Organ insufficiency	763.13	342.77		

Discussion

Abcesses of odontogenic origin which are frequently seen in the maxillofacial region should be rapidly and correctly treated in order to prevent unwanted consequences. In dentistry, abcesses are usually treated with surgical drainage and antibiotic use. This process should be followed either by

the extraction or root canal treatment of the tooth causing the lesion. Abcess of odontogenic origin are usually diagnosed between the ages of 31 and 45 years. Untreated cases or those treated inadequately might lead to life threatening complications (2). In one study (3) mean age was 35.8; and in another (4) which examines the clinical course, predisposant factors and complications arising from odontogenic abcesses of the maxillofacial region, the age range of the participants was reported to be between 31 to 50 years. Consistent with these findings, mean age of our study population was 39 years.Symptoms such as facial swelling, pain, trismus, dysphagia, dyspnea, deviated uvula, raised floor of the mouth, leukocytosis and fever are prominent findings of abscesses of odontogenic origin (2, 3). All patients in our study had pain and swelling. Trismus was present in 56.7% of the subjects and 9 had dysphagia. Leukocytosis was detected in 36.7% of the cases and 70% demonstrated clinical fever. When these symptoms were evaluated with respect to the hospital length of stay, statistical difference found in the hospital length of stay of patients with dysphagia, indicates that the presence of dysphagia causes longer duration of hospitalization. However, there were no significant differences in the hospital length of stay with respect to the presence fever, trismus or leukocytosis symptoms.

Seppanen *et al.* (5) have emphasized that systemic diseases, particularly diabetes mellitus, are predisposing factors for odontogenic infections and they could complicate the treatment process. Another study has shown that the diabetes mellitus increased the risk of odontogenic infection (4). Our findings also demonstrated a significant relationship between the presence of systemic disease and hospital length of stay, which indicates that the presence of systemic disease could increase the duration of hospitalization. However, this relationship had no impact on the treatment cost. CT can locate abscesses spreading to parapharyngeal, submandibular and sublingual spaces, muscles of mastication, as well as fluid collections (6). MRI is widely regarded as the gold standard of imaging for soft tissue lesions and maxillofacial infections. USG is an inexpensive, non-invasive, sensitive and easily available imaging modality with which lymph nodes in head and neck region, salivary glands, vascular formations and inflammatory lesions can be examined. However, USG is known to be inferior to MRI in determining the boundaries of infection in deep tissues (7). CT was used in 50% of the cases in our study, which is followed by CT + MRI, MRI and USG, in descending order of frequency.

Boffano *et al.* (2) have reported that the amoxicillin clavulanate and ceftriaxone were effective antibiotics in the treatment of odontogenic infections with no side effects. In a study which investigates the susceptibility of pathogens in oral abcesses to penicillin, clindamycin, doxycycline, amoxicillin clavulanat and moxifloxacin showed that the penicillin was not the most effective antibiotic when compared to clindamycin, doxycycline, amoxicillin clavulanat and moxifloxacin. Moxifloxacin was found to be the most effective antibiotic regimen; however, the oral pathogens were also observed to be susceptible to conventional penicillin therapy (8). Most effective antibiotic should be administered in the treatment of odontogenic infections. Clindamycin or penicillin combined with metronidazole have been proposed as the first line treatment (9). In another study, it was found that the routine use of amoxicillin clavulanic acid combination was effective in deep infections of the head and neck region and no side effects have been reported. Substitution of moxifloxacin for clindamycin in patients who are allergic to penicillin has been reported to show high rates of resistance (10). Kulkarni *et al.* (11) have shown that the penicillin G was highly effective against gram positive aerobic and facultative anaerobic bacteria in the treatment of odontogenic infections. In one study (12) which reports the antibiotic use in odontogenic infection of the maxillofacial region, penicillin, penicillin with metronidazole, clindamycin, cephalosporin and combination of gentamicin-ampicillin-metronidazole were used based on the severity of infection. In our study, we have used sultamicillin, sultamicillin and metranidazole, clindamycin, clindamycin and trimethoprim, ceftriaxone, ceftriaxone and metranidazole, teikoplanin, potassium clavulanic acid, potassium clavulanic acid and metronidazole.

In various studies in which clinical presentation of and treatment approach to odontogenic infections are evaluated, general treatment principles include eliminating the cause, draining the infection and using intravenous antibiotic. Tooth from which the infection is originated from should be extracted or treated endodontically as soon as possible. Abcess drainage is critical for the success of treatment (2, 5, 8, 13). An abcess of odontogenic origin in maxillofacial region could be easily diagnosed and treated during routine dental examination. Finalizing the treatment of abcesses in the early phase of routine controls also

prevents the financial burden on health care system (14). Allareddy *et al.* (15) who have investigated the relationship between dental health and hospital cost have emphasized the importance of preventive dentistry. Based on this previous knowledge, we think that dental practitioners should provide early treatment to patients with odontogenic infection, or refer them to an oral surgeon who will apply drainage and use proper antibiotic regimen. Thus, the need for treatment in inpatients units can be prevented.

Odontogenic infections cause high costs for hospitals (13). Mean hospital cost have been reported as 749.38 $ (3). Consistent with this finding, we have calculated 748.35 TL as the mean cost of treatment for odontogenic infections in hospital settings.

Conclusion

In order to prevent infections of odontogenic origin; oral health must be protected, routine follow-up visits should be maintained and necessary treatment should be provided in a timely manner. Surgical drainage is the most effective method of treatment and antibiotic theraphy is an important adjunct to surgery. As suggested in general health insurance code, unhindered access of children to health care services* is important in protecting their health in later stages of life, as well as in reducing social security expenditure. Preventive measures should be taken to avoid unnecessary costs. Resources should be used efficiently in order to improve health care quality.

Dental professionals should possess necessary skills to diagnose and eliminate odontogenic infections or to refer patients for specialized treatment in timely manner. Treatment of severe odontogenic infections brings high cost to inpatient units. Mean hospital length of stay calculated in our study was 8.1 days. This can create important limitations in bed occupation rates, budget expenditure and staff allocation. In addition, treatment costs might also be increased by the need of prosthetic rehabilitation due to tooth extraction and structural problems.

*Act number 5510-60/g

Source of funding
None declared

Conflict of interest
None declared

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