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"Risk Factors" for Life Threatening Complications Associated with Maxillofacial Space Infections: A Clinical Study

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Abstract

Background: Maxillofacial Space Infections (MSI) are commonly observed in our clinical practice that may cause morbidity and mortality. The objective of this study was to review the clinical characteristics, to identify the factors predisposing to life-threatening complications and outcome of odontogenic Maxillofacial Space Infections treated at a tertiary care center.

Methods: Age, gender, etiological factors, clinical presentation, associated systemic disease, respiratory difficulty, fever, White Blood Cell Count (WBC) were recorded. The investigations were performed, medical & surgical treatment carried out and outcomes were studied. Length of hospital stay and any complications were also noted. Univariate logistic regression analysis was performed to calculate the Odds Ratio (OR) and to identify potential risk factors associated with life-threatening complications (p-value < 0.05 was statistically significant). Multivariate logistic regression analysis for significant risk factors, were used to model the influence of covariates on risk of life-threatening complications.

Results: Out of 230 patients identified, 55.2% were male. The most common origin was odontogenic 70.8%. The most common space involved was the submandibular space both in single and multiple space infections (40% and 80 %, respectively). Multiple space infections were found in 130 patients (56.5%). In patients >60 years old 53.3% had life-threatening complications. Elderly patients, underlying systemic disease, multiple space involvement, respiratory obstruction, self-medication, trismus fever >103 F^0 and WBC > 12×10^9/l were associated with complications.

Conclusions: Patients with MSI who present with multiple space involvement, a high leukocyte count, fever > 103F^0 and those with underlying systemic diseases are at higher risk of developing life-threatening complications and require early adequate treatment of their conditions and close clinical monitoring.

Keywords: Maxillofacial space Infection (MSI), Odontogenic infection, White blood cell count (WBC), Limitation of mouth opening (trismus); Computed tomography (CT Scan)

Introduction

Globally odontogenically sourced infections and a major proportion of Maxillofacial Space Infections (MSI) contribute to a high percentage of infections across the world[1]. Uncontrolled odontogenic infections may spread to adjacent head and neck facial spaces [2], lead to life threatening complications like respiratory obstructions, necrotizing fasciitis, pericarditis, descending mediastinitis, artery rupture, brain abscess and sepsis [3].

These conditions require immediate hospitalization with intravenous antibiotics, incision and drainage. Prolonged hospitalization can also become an economic factor for both the patient and society. As they generally respond well to dental care, antimicrobial therapy, and surgical intervention [4]. So familiarity with the clinical features of MSI, early recognition, timely therapy to avoid lethal complication is important.

Risk factors, which are associated with increased potential for complications in odontogenic infections includes the presence of co-existing major systemic disease including diabetes mellitus, bleeding dyscrasias, steroid therapy, immune suppression and malnutrition [5,6].

The literature has well documented epidemiological studies on odontogenic infections in different parts of the globe [5-8] but to the best of our knowledge, there is no report of such study from Pakistan. Its important pertaining to specific areas to analyze facts off their Individual location (region) so that specific recommendation on prevention and management can be targeted to the need of the population. Therefore, the present study was designed to evaluate all patients with maxillofacial space infections who were presented to our center at Lady Reading Hospital (LRH), Peshawar. The aim of this study was to identify clinical characteristics, factors predisposing to life-threatening complications and their treatment modalities in our region.

Materials and methods

This clinical study analyzed 230 patients admitted to the department of Dentistry and maxillofacial surgery in Lady Reading Hospital (tertiary care) during five years' period (June 2009 to December 2014). Ethical committee of Lady Reading Hospital Peshawar has given the approval for this study and the written informed consent was taken from each patient. The data were collected on a well-structured performa. The inclusion criteria for this study were the consecutive patients of both gender, any age group diagnosed for MSI with maxillofacial space involvement admitted to hospital. Patients with MSI treated as outdoor and not admitted were excluded. The variables that were studied include age, gender, etiological factors, clinical presentation, associated systemic disease, respiratory difficulty, fever, White Blood Cell Count (WBC), medical & surgical treatment, length of hospital stay, and complications.

The diagnosis was based on detail history, clinical examination (including needle aspiration) and CT (Computed tomography) scan and ultrasound for which space is involved. The infection was categorized according to its characteristic cellulitis vs abscess on the basis of needle aspiration/ surgery. Treatment prior to presentation was noted as antibiotic only, dental treatment/ presentation to a dentist, and self-treatment.

On first visit, all patients were placed on intravenous antibiotics (Penicillin and metronidazole) and IV fluids. However immediate surgical drainage was performed in patients who have compromised air way or signs & symptoms of sepsis. The rest of the patients without dyspnea and sepsis were observed for 48 hours and if no improvement in symptoms and signs were seen, surgical drainage was performed by confirming the abscess from CT, so as to avoid life-threatening complications. Culture and sensitivity was performed. But blind antibiotic therapy was performed without waiting for culture and sensitivity test for bacterial growth. No resistant case was reported to antibiotic therapy used in this study.

The potential risk factors for life- threatening condition and complications were identified by analyzing gender, age, oral hygiene status (by intra oral examination), self-medication, character and location of infection, underlying systemic disease, respiratory difficulty, trismus, fever and WBC count.

Univariate logistic regression analysis was performed to calculate the Odds Ratio (OR) and to identify potential risk factors associated with life-threatening complications. A p -value of < 0.05 was considered to be statistically significant. Multivariate logistic regression analysis for significant risk factors, were used to model the influence of covariates on risk of life-threatening complications. Descriptive statistics such as frequency and percentage were used to analyze the related factors. Data were calculated using SPSS version 18.0 (SPSS Inc., Chicago, USA).

Results

A total of 230 patients with Maxillofacial space infections were included in this study, with 127 males (55.2%) and 103 females (44.8%), with an age range of 1–85 years. The characteristics of patients are shown in Table 1 & Table 4.

The cause of infections was identified, 77.4% had an odontogenic etiology followed by non odontogenic infection (22 % with lymphadenitis (6.5%), trauma (4.3%) and tonsillitis (0.9%)) Table 2. The submandibular space was the space most commonly involved in both single space and multiple space infections (40% and 80 %, respectively). The distribution of the single involved spaces and multiple space infections are shown in Table 3.

Sixty-six patients (28.6%) including 36 males (28.3%) of total males and 30 females (29.1%) had life-threatening complications Table 4. Out patients with life-threatening complications, 40 patients took self-medications and never visit to a dentist for that problem. Out of sixty-six, 30 patients (68.2%) had an underlying systemic disease, compared to 36 (19.4%) of patients without life-threatening complications. Diabetes mellitus was the most common underlying systemic disease in patients (18 patients)

Table 1: Patients' characteristics (n=230).

Characteristics	n (%)
Age	
• >60	30 (13.04%)
• <60	200 (86.9%)
Gender	
• Male	127 (55.2%)
• Female	103 (44.8%)
Oral hygiene status	
• good	40 (17.4%)
• Satisfactory	60 (26.1%)
• Poor	130 (56.5%)
Location	
• Maxilla	70 (30.4%)
• Mandible	90 (39.1%)
• Maxilla and mandible	10 (4.3%)
• Other non-odontogenic	32 (13.9%)
• Unknown	28 (12.2%)
Character of infection	
• Abscess	114(59.5%)
• Cellulitis	116(50.4%)
Trismus	140 (60.8%)
Fever > 103 ^{0}F	60 (26.08%)
WBC> 12x10^9/L	100 (43.4%)
With underlying systemic disease	44 (19.1%)
With respiratory difficulty	40(17.4%)
Self-medication	40(17.4%)
Treatment	
• Antibiotic only	36 (15.7%)
• Extraction with antibiotic	40(17.4%)
• I/D with antibiotic	16(7%)
• I/D, Extraction with antibiotic	138 (60%)
Length of Hospital stay	
• Not admitted	44 (19.1%)
• 1-3 days	136 (59.1%)
• 3-7 days	50 (21.7%)

Table 2: Causes of Maxillofacial space infections (Odontogenic / Non-odontogenic).

Etiology	Frequency	Percent
Periapical Infection (odontogenic)	100	43.5
Pericoronitis (odontogenic)	58	25.2
Other (odontogenic)	20	8.7
Lymphadinitis (Non Odontogenic)	15	6.5
Trauma (Non Odontogenic)	10	4.3
Infected Jaw Cyst (Non Odontogenic)	5	2.2
Tonsilitis (Non Odontogenic)	2	0.9
Unknown (Non Odontogenic)	20	8.7
Total	230	100

Table 3: Distribution of spaces involved in single vs multiple space infections.

Involved Space	Single(n=100) No of cases (43.4%)	Multiple(n=130) No of cases (56.5%)
Submandibular space	40 (40%)	80(26.08%)
Submental	2 (2%)	40(13.04%)
Sublingual	2 (2%)	35(11.41%)
Buccal	10 (10%)	25(8.15%
Masseteric	16(16%)	35(11.41%)
Infraorbital	15(15%)	9(2.93%)
Pterygomandibular	4(4%)	22(7.17%)
Parapharyngeal	4(4%)	20(6.52%)
Lateral pharyngeal	0(0%)	15(4.89%)
Temporal	4(4%)	20(6.52%)
Infratemporal	2(2%)	5(1.63%)
Parotid	1(1%)	0(0%)
Total	100	306

with life-threatening complications. Among the 40 patients with respiratory difficulty obstruction, 7 underwent an emergency tracheotomy, 4 underwent emergency endotracheal intubation, and 21 underwent incision and drainage and antibiotics.

The results of univariate logistic regression analysis are shown in Table 4. Patients over 60 years old had significantly more life threatening complications (53.3%) than younger patients (25%) (p = 0.001).Patients with bilateral space involvement had more complications 73.3% than with unilateral space involvement (22%) (p=0.000).Similarly patient having fever > 103 F^0 (p = 0.001) and WBC > 12×10^9/l at the time of admission had more complications (p = 0.003). Patients with respiratory difficulty (87.5%) had significantly more life-threatening complications than those without respiratory difficulty (16.3%) (p = 0.004).

The results of univariate logistic regression analysis indicated that older age, bilateral space involvement, presence of trismus and cellulitis, self-medication, high admission temperature and higher WBC count, respiratory difficulty, and underlying systemic diseases, were significantly associated with life-threatening complications.

The results of multivariate analysis indicated that age, multiple space involvement, underlying systemic disease, WBC count, respiratory obstruction, self-medication, trismus and high fever were associated with life threatening complications Table 5.

Of the 230 patients, 153 had a culture and sensitivity report on the exudates or pus obtained from the sites of infection. Cultures always showed mixed infections with a variety of Gram-positive and Gram-negative organisms, and many with anaerobic

Table 4: Patient characteristics and complications (Univariate Analysis).

Variables	Categories	With complication (%)	Without complications (%)	P value	OR (95% Cl)
Age(years)	<60 >60	50 (25%) 16 (53.3%)	150 (75%) 14 (46.7%)	0.001[a]	0.29 (0.13-0.64)
Gender	Male Female	36 (28.3%) 16 (29.1%)	91 (71.7%) 73 (70.9%)	0.897[a]	0.96 (0.54-1.70)
Space involved	Single Multiple	26 (26%) 40 (30.9%)	74 (74%) 90 (69.2%)	0.428[a]	0.791 (0.44-1.41)
Side of space	Unilateral Bilateral	44 (22%) 22 (73.3%)	156 (78%) 8 (26.7%)	0.000[a]	0.10 (0.04-0.24)
Character of infection	Cellulitis Abscess	45 (38.8%) 21 (18.4%)	71 (61.2%) 93 (81.6%)	0.625[a]	2.80 (1.53-5.13)
With underlying systemic	Yes No	30 (68.2%) 36 (19.4%)	14 (31.8%) 150 (80.6%)	0.001[a]	8.92 (4.29-18.55)
With respiratory obstruction	Yes No	40 (100%) 31 (16.3%)	0 (0%) 159 (83.7%)	0.004[a]	35.90 (13.03-98.8)
Self-Medication	Yes No	20 (50%) 46 (24.2%)	20 (50%) 144 (75.8%)	0.001[a]	3.13 (1.55-6.32)
Trismus	Yes No	50 (35.7%) 16 (17.8%)	90 (64.3%) 74 (82.2%)	0.003[a]	2.56 (1.35-4.88)
Fever>103F^0	Yes No	50 (83.3%) 16 (12.3%)	10 (16.7%) 154 (90.6%)	0.001[a]	48.12 (20.5-112.)
WBC>12×10^9/l	Yes No	50 (50%) 16 (12.3%)	50 (50%) 114 (87.71)	0.003[a]	7.12 (3.7-13.7)

OR, odds ratio, CI, confidence interval, WBC count, Chi-square test

Table 5: Patient characteristics and complications (Multivariate Analysis).

Variables	P value	OR (95% CI)
Age(years)	0.028	3.97 (1.17-12.68)
Multiple Space involved	<0.001	13.12 (4.09-48.52)
underlying systemic Disease	<0.001	4.46 (1.70-6.92)
Fever>103F^0	<0.001	18.08 (5.89-61.37)
WBC>12×10^9/l	0.505	2.45 (0.7-9.98)
Respiratory Obstruction	0.003	5.46 (1.66-6.87)
Self Medications	0.001	3.68(0.9- 5.68)
Trismus	0.045	5.05 (1.55-4.57)

OR, odds ratio, CI, confidence interval, WBC count

organisms. The patient's treatment or antibiotics were not changed as a result of the culture.

Discussion

The outcomes in the existing analysis mentioned that the odontogenic infections with life threatening complications having existence intimidating issues grew more prevalent in > 60 years old patients. In this study 25% of patients with life-threatening complications in < 60 years, while 75% of those without life-threatening complications were < 60 years old. In patients > 60 years old 53.3% had life-threatening complications and 46.7% of those without life-threatening complication.

Systemic conditions were being specific to 68.2% regarding individual having life-threatening issues when compared with 19.4% devoid of issues. This is consistent with the result of the analysis conducted by zhung, et al. in which 66.7% had systemic disease [10]. Compared with the non-elderly patients, the elderly patient have more systemic diseases and develops more frequent complications [11]. Similar to this study, other studies have also shown that older age and systemic diseases are potential factor and had significant association with the life-threatening complication [10,11,12].

Swelling of the tissues adjoining the particular areas inside floor boards in the jaws or the laryngeal edema may end in breathing blockage, even asphyxiation. In this study submandibular space involvement as single or multiple spaces were the most common space (40%, 26% respectively). These findings are similar to the findings of Rao and Kinzer, et al. [13,14]. Moreover multiple spaces involvement were more common than single space like our study. Patients with cellulitis of the floor of the mouth of which 11.4% had sublingual space infections, 13.04% had submental space infections, and 6.5% had parapharyngeal space infections. These spaces can cause upper airway obstruction. Therefore, close monitoring is required in these patients for impending respiratory obstruction so that emergency measures like endotracheal intubation or tracheotomy can be performed, if necessary [15].

Our study found that 40 patients (17.3%) had self-medicated before admission and they did not visit to a dentist before for that problem and it is a great issue of concern in our population. Through univariate regression analyses, we also found 50% of patient with life threatening complication had self-medication. This study shows that self-medication increases the risk of life-threatening complications, probably as a result of a delay in presentation. Thus, patients with self-medicate may require more aggressive treatment to avoid life-threatening complications [12]. It is suggested that policy changes may be required regarding drug control and drug prescription.

According to this study Patients aged > 60 years, with an admission temperature > 103 F^0 and WBC > 12×10^9/l, or those who have self-medicated, respiratory difficulty, or underlying systemic diseases require a high index of suspicion for potential life-threatening complications similar to the suggestions made by Marioni, et al. [16]. Therefore, early recognition, aggressive antibiotic treatment, timely surgical intervention and control of any underlying systemic disease are essential to minimize the mortality in these patients.

The treatment of facial space infections includes aggressive intravenous high dose antibiotics (usually penicillin or cephalosporins and metronidazole), analgesic and fluid therapy in addition to establishment of surgical drainage and elimination of the source of infection [17]. In the present study, the suspected culprit teeth extraction and antibiotics were done in about forty patients 17.4%. One hundred and thirty-eight patients (60%) were treated by incision and drainage, extraction of involved tooth and antibiotics, whereas 36 (15.5%) patients were treated with antibiotics alone.

As stated in other reports, odontogenic infections are the most common cause of maxillofacial space infections [10,18,19]. This study also shows that 77.4% of the patients had odontogenic cause infections. Due to limited health education [19-21] irregular visit to a dentist and poor oral hygiene lead to odontogenic infections. and change the paragraph. Based on our data 56.5% of the patients had poor oral hygiene in patients with maxillofacial space infections. This study also agrees with the previous studies [10,15,18] that patients with poor oral hygiene are more likely to have maxillofacial space infections because of ignored dental care.

Regular dental visits may enhance early detection and treatment of dental ailments, thereby preventing progress of maxillofacial space abscess or cellulitis. Therefore, oral hygiene care in elderly should be emphasized, especially among elderly patients with underlying systemic diseases. In cases of established infections, early recognition and treatment is necessary to prevent considerable morbidity and mortality, especially in elderly patients with an underlying systemic disease.

Morbidity and mortality of patients with maxillofacial infections inspire to investigate this study. The study suggests that maxillofacial infections should not be ignored on initial presentation. It may cause serious consequences for the patients if not treated properly and in time. General practitioners should take immediately simple measures like medications (proper

antibiotic), early extraction of involved teeth and referral of elderly patient with relevant systemic disease, multiple space involvement and high fever with maxillofacial infections to Oral & Maxillofacial Surgeon for management. Experience has shown that simple toothache due to infection was not paid proper attention and this negligence lead to severe morbidity and mortality.

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Ethical approval

The Ethical Committee of Government Lady Reading Hospital had given the approval for this study.

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