Factors influencingManagement Outcome of Hospitalised Patients with Odontogenic Infection

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Abstract
Introduction Facial cellulitis and abscesses are common in public health problems and early recognition and management is critical, as they are becoming more severe with a noticeable increase in hospitalization. Despite the plethora of studies on odontogenic infections, there are no previously published studies about odontogenic infection outcome of the Iraqi population. **Aim**This study was conducted to determine factors influencing the clinical outcomes of hospitalized patients with odontogenic infections. **Material and method** This cross sectional study was carried out in the oral and maxillofacial surgery department in Sulaimani teaching hospital, Kurdistan-Iraq. Sixty patients with odontogenic infection were hospitalised and treated surgically by incision and drainage, removal of the cause and antibiotic. Treatment outcomes were evaluated. The data were statistically analyzed and compared. **Results** The highest incidence of infections was found in the sub-mandibular and infra-orbital spaces (28.3% and 28.3% respectively). A significant relationship was found between trismus severity and the space involved (p= 0.000). Sub-masseteric space was more associated with grade III trismus and the longest duration of hospitalization. The relationship between type of involved space and duration of hospitalization was significant (p=0.000). Patients treated with Amoxicillin showed statistical reduction in the duration of the drain need (p = 0.022), hospitalization time (p = 0.002). A significant negative relation between the time of removal of infection cause and duration of hospitalization (p=0.001) was seen. The study showed a positive correlation between severity of trismus and duration of drain placement (p=0.001), duration of antibiotic and hospitalization (p=0.00). **Conclusion** Early removal of the causative tooth and severity of trismus seem to influence the odontogenic infection management outcome in terms of duration of antibiotic use, duration of drainage and hospital stay.

Keywords: Odontogenic infection, trismus , facial spaces

Introduction

Facial cellulites and abscesses are common public health problem. They usually originate from periapical or lateral periodontal infections , disseminate through soft tissue spaces surrounding jaw bones (Mahmoodi et al., 2015; Uluibau et al., 2005). They can lead to potentially life threatening conditions like cervical necrotizing fasciitis, necrotizing mediastinitis and orbital abscess. Early management of acute orofacial infections is crucial and regarded as emergency (Seppanen et al., 2010). Odontogenic infections are becoming more severe with noticeable increase demand

in antibiotic consumption (Seppanen et al., 2008; Zamiri et al., 2012). In the Middle East, odontogenic infections are not uncommon. In Saudi Arabia , a study revealed that 25% of oral and maxillofacial cases were of odontogenic infection (Parker and Khateery (2001), and in a study conducted on head and neck infections of hospitalized patients , 34.3% of infections were of odontogenic origin (Zamiri et al (2012)
Despite there are several papers in the literature regarding odontogenic infections (Cachovan et al 2009), and the fact facial infections of odontogenic origin are common in Iraqi population (Maki), there are no previously published studies evaluating the influencing factors on patient's management outcomes.
The treatment of odontogenic infections is based on two main elements: surgical treatment and antibiotic therapy. Antibiotics are essential adjunct and are indicated when there are clear signs of systemic involvement such as pyrexia, lymphadenopathy, difficulty in swallowing, and lockjaw (Cachovan et al 2009) .
Many risk factors could influence the outcome of odontogenic infections. Among these are the presence of co-existing major systemic disease interfering with normal healing processes, including diabetes mellitus, bleeding dyscrasias, steroid therapy, immune suppression and malnutrition. Many tests were used to investigate the general condition of the patients with odontogenic infection (Helfrick and Kelly 1992), but there are limited literature evaluates the role of systemic factors in the spread of odontogenic infections (Bakathir et al 2009).

Aim of the study
The aim of this study was to determine the influence of factors related to odontogenic infection on clinical outcomes of hospitalized patients .

Materials and method
Sixty patients admitted to the Oral and Maxillofacial Surgery unit at Sulaimani teaching hospital in Kurdistan-Iraq and were included in the study. All the patients had symptoms of acute odontogenic infections in form of abscess or cellulites requiring surgical drainage, antibiotic and removal of the offending tooth.
Inclusion criteria: Adult patients with odontogenic infection spread to the soft tissue spaces in the form of severe cellulites or abscess, necessitate antibiotic therapy, incision, drainage and removal of the cause.
Exclusion criteria: Children, medically compromised patient with diseases or conditions affecting their immune system, metabolic diseases, patients received any antibiotic treatment during the course of the odontogenic infection and, patients presented with other existing infections at the time of admission.
Baseline information for the admitted patients was documented, clinical signs and symptoms were assessed, and laboratory and radiological investigations were ordered. Aspiration test was performed for every swelling. Swelling size was measured by measurement tape scale, which was performed by measuring the distance between two anatomical points. Patient's mouth opening was assessed using vernia scale. Grade I trismus was considered with inter-incisal distance (MID) 25- 40 mm, grade II if MID was 10-25 mm and Grade III when the MID was less than 10 mm (Wranicz et al., 2010).
Patients were treated according to standard treatment protocol (Cachovan et al., 2009): surgical incision and drainage for abscess; endodontic treatment or removal of the offending tooth and antibiotic as adjuvant to surgical treatment. The treatment

choice was based on patient's sensitivity and availability of the medication. Twenty five patients were treated with parenteral Amoxicillin i.m. injection (500mg t.i.d), 19 patients with parenteral Lincomycin (300-600mg t.i.d) and 16 patients with combination of Amoxicillin and Metronidazole infusion 500mg t.i.d. Clinical signs and symptoms were evaluated on second, third, fifth and seventh day after starting treatment. Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences-version 21.0). Descriptive statistics were calculated for all variables, as well as analytical statistics was done to find the relations between variables using Mann-Whitney Test for non parametric difference analysis. Chi-square, Pearson, Spearman correlation analysis tests. Statistical significance was considered at p-value < 0.05.

Results

Females were more than males in the study sample (58% and 42%, respectively). The age mean was 28.20 years old.

Submandibular space (28.3%) and infraorbital spaces (28.3%) reported the highest incidence of infections. Temporal space was the least common involved space (Table 1). The relationship between the involved space and duration of hospitalization was highly significant (p=0.000) with sub-masseteric abscess associated with maximum duration of hospitalization (7.67day) (Figure1).

Table (1) frequency of Spaces involvement

Spaces	Frequencies	Percentages
Sub mandible	17	28.3
Sub mental	4	6.7
Submassetric	6	10.0
Buccal	11	18.3
Infra orbital &(canine space)	17	28.3
Infra temporal & deep temporal	1	1.7
Vestibular	4	6.7
Total	60	100

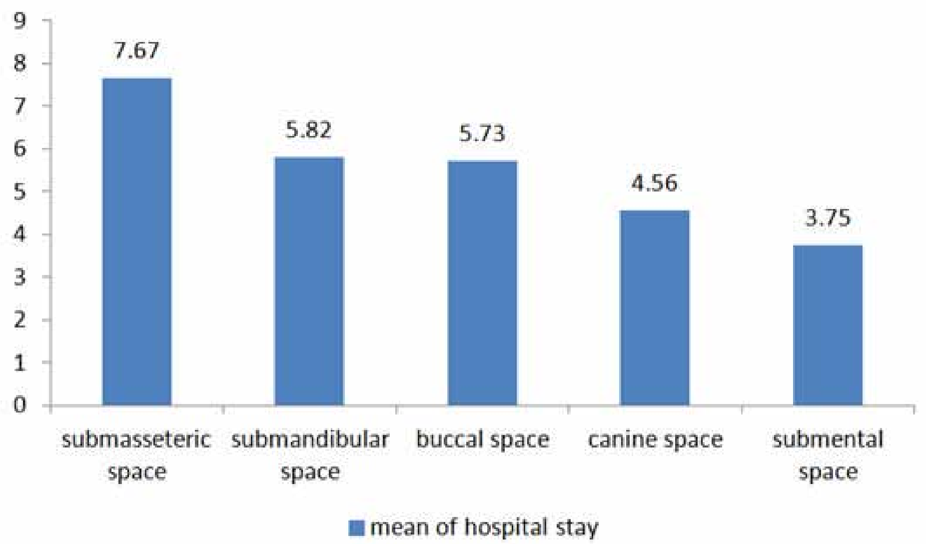

Figure 1, Mean of duration of hospital stay by space

Forty-seven patients (78.3%) had positive pus aspirate, whereas the pus aspirate was negative in 13 patients (21.7%). The definitive diagnosis relied on incision and drainage. The vast majority of cases (85%) were abscesses. Culture and sensitivity test was performed only in 35 cases. However, bacterial growth was not positive in all of these cases.
Trismus of grade I reported the highest incidence followed by grade II (41% and 32.8% respectively). Grade III trismus found in only 9.8% (Figure 2). Half of Submasseteric space infection, patients had grade III trismus, over half were associated with grade II (Figure 3). Spearman Correlation Test showed a significant relationship (p=0.01) between trismus severity and space involved.

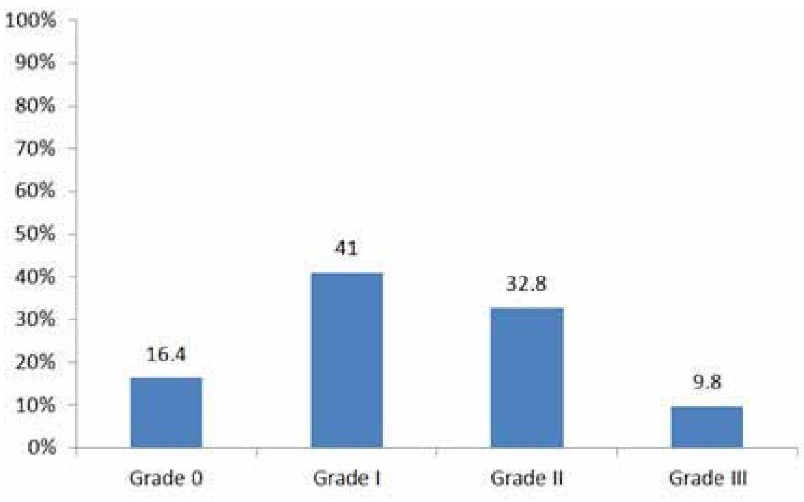

Figure 2, Frequency of trismus by grade

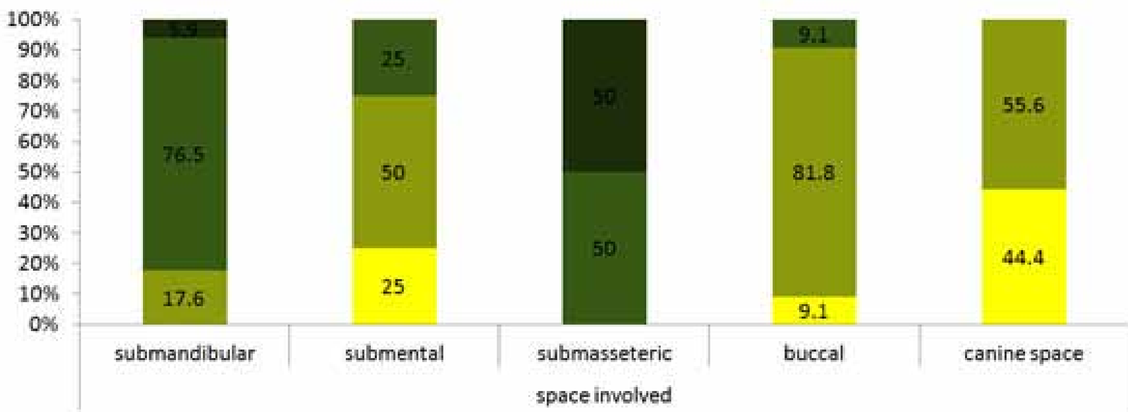

Figure 3, Trismus grade by space

A positive correlation was observed between severity of trismus and duration of antibiotic intake (Figure 4), duration of drainage and duration of hospitalization. A significant correlation between severity of trismus with drainage time (p=0.001), duration of antibiotic intake and duration of hospitalization (p = 0.000).
Amoxicillin was used alone in 41.6% of patients, and in combination with Metronidazol at 26.6%. Lincomycin was used in 31.6%. Lincomycin group reported the longest

duration of use. However, no statistically significant difference was found between the choice of antibiotic and duration of its intake (p=0.667). In this study a statistical difference was reported in the duration of drainage among patients treated with different kinds of antibiotics. The shortest duration of drain need was reported among patients treated with amoxicillin (p=0.022).
A significant statistical difference was reported in the duration of hospitalization with the shortest duration was in patients treated with Amoxicillin (p=0. 022). Table 2 demonstrates that the short duration of hospitalization was reported among amoxicillin group patients. The statistical relationship was significant (p=0.022).

Table (2) Relation between the duration of antibiotic, duration of drain placement and duration of hospital stay, by antibiotic type

Variables	Types of drugs Mean ± Std. Deviation			P values
	Amoxicillin	Amoxill + flagyl	Lincomycin	
Duration of Antibiotic Use	4.04±2.54	3.75±2.86	4.53±2.41	0.667
Duration of drain	2.20±1.68	3.63±1.89	3.58±2.09	0.022
Duration in hospital stay	4.04±2.33	6.06±1.76	6.89±3.47	0.002

White blood cell count in the included group of patients ranged from 6000-23000/mm3 (mean=10. 000, ST=3.02). There was no significant correlation between the white blood cell count (WBCC) and duration of antibiotic use. In addition, no significant correlation was found between WBCC and duration of drain in place (p= 0.29), and WBCC and hospitalization time (p=0.26). However, a significant relationship between WBCC and the

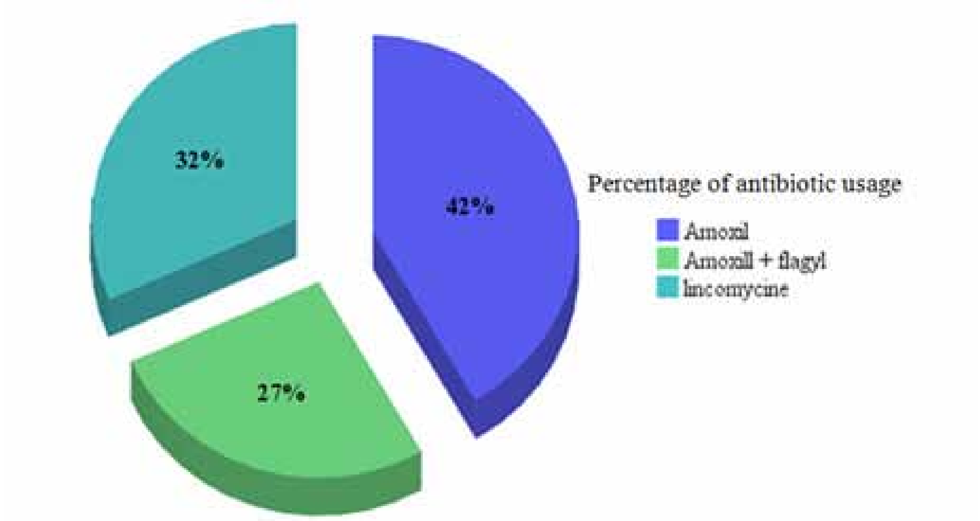

Figure 4, Mean of antibiotic, drain duration and hospital stay by trismus.

size of the swelling has been found (p=0.02). The mean haemoglobin for the participant was 12.81 gm/dl. There was no significant relationship between haemoglobin level with a duration of antibiotic use (p=0.46) and with duration of drainage (p=0.63). The study showed an interesting positive correlation between the time of the elimination of the infection source (offending tooth) and all treatment parameters. Duration of hospital stay was significantly reduced in early removal of the causative tooth (p=0.001). There were no reported complications for all the patients included in this study.

Discussion

In the literature, various local and systemic factors have been reported to influence the severity of orofacial infections and their management outcome. These included age, number of fascial spaces involved (Zamiri et al., 2012), socioeconomic status, smoking((Bakathir et al., 2009), patients' systemic health (Kamat et al., 2015; Peters et al., 1996), location of infection (Peters et al., 1996), space proximity to airway (Sette-Dias et al., 2012), level of education and the nature of medical practice (Fomete et al., 2015).

In this study, the submandibular and infraorbital spaces were more common than other spaces. Sub-massetric space infection was found in 10%. Involvement of more than one space was found in 29.5%. Infection is usually favoured easy spread in these spaces due to their anatomical nature and their location in relation to commonly affected teeth by infection.

High involvement of submandibular space agrees with the findings other studies (Bakir et al., 2012; Fomete et al., 2015; Parker and Khateery, 2001; Pourdanesh et al., 2013; Zamiri et al., 2012). Submandibular reported in 46.45% in Ishfaq et al 2012 study. Infraorbital (canine) space involvement was not found to be common in the literature (Veronez et al., 2014). High incidence of infraorbital space infection in this study might be explained by included patients' negligence. Anterior teeth involvement in dental caries reflects a certain degree of oral hygiene awareness.

In the current study, the influence of involved space on duration of hospitalization is found to be significant, with the sub-masseteric abscess associated with maximum hospital stay. Submandibular and buccal spaces reported comparable duration (5 days). This agrees with the results of Peters et al (1996).

The significant positive relationship between the duration of hospitalization and the timing of extraction of the offending tooth is understood, since delay elimination of the causative factor leads to persisting infection with more chance of pus formation and delayed improvement of the condition. This indicates the importance of early removal of the infection source, which is usually performed by extraction of the causative tooth. The reason for the delay in extraction could be explained by in ability to obtain effective anesthesia on an infected area and the difficulty to access teeth, especially molar teeth due to trismus.

Trismus related fascial space infection could be of variable degrees. The most severe type of trismus (grade III) was associated with sub-masseteric space abscess (in half of the cases). The other half of cases with sub-masseteric abscess were associated with grade II trismus. Grade II trismus affected 76.5% of patients with submandibular space infection. The high incidence of trismus in these spaces might be explained by the extent of swelling that interfers with jaw movement with related pain. This agrees with the fact that trismus usually complicates odontogenic infection involving masticatory spaces (Flynn, 2004).

There are case in the study (16.1% of patients) were free of trismus, and 73.8%

were presented with trismus in both grade I and II. This could be related to the fact that mild cases of odontogenic infection with no trisumus or mild cases of trismus are already treated primary health care centres.This agrees with (Steinkeler, 2014) and (Uluibau et al., 2005) . High incidence of trismus in the present study compared to Rehmann et al (2005) might be explained by lack of adequate attention paid by other studies to this influential variable as confirmed by the influence trismus has on the duration of antibiotic intake, drainage period and duration of hospitalisation.
The highest duration of hospitalization was found in both sub-masseteric and sub-mandibular space, which were associated with Grade II and III trismus. This result highlights that degree of mouth opening can be considered as useful predictor for seriousness of the condition and that attention should be directed toward correction of trismus throughout the treatment course.
Trismus causes difficulty in performing tooth extraction and delays completion of the treatment (Flynn et al., 2006). Trismus must be thoroughly evaluated so that a potential life-threatening situation is discovered as early as possible (Dhanrajani and Jonaidel, 2002). Treatment of trismus requires physical therapy by active and passive range of motion devices. Additionally, control of symptoms with pain medications (NSAIDs) and muscle relaxants. Pain can affect the performance of physiotherapy and it is the causative factor of trismus in many patients.
In the current study, the selection of antibiotic for treatment was almost depended more on sensitivity test and availability. Amoxicillin was the first choice of treatment and was used more than other antibiotics; alone or in combination with Metronidazol. Penicillin group remains the antibiotic of choice in the majority of published studies (Bakathir et al., 2009; Mahmoodi et al., 2015; Pourdanesh et al., 2013; Sixou et al., 2003; Zamiri et al., 2012). The use of Amoxicillin as first choice was supported by the fact that patients whom were under this antibiotic had the shortest drainage time and hospital stay. Amoxicillin is bactericidal, broad-spectrum antibiotic covers most of species of odontogenic infection bacteria leads to early remission. The shorter time needed for drain in use can explain the early discharge the patient from the hospital. However, this study finding seems to disagree with Formete et al, who did believe that the type of antibiotic influences hospitalization time (Fomete et al., 2015).
The range of hospital stay as reported in the current study is comparable to what has been reported in the literature (5.1 to 14.8 days) (Sette-Dias et al., 2012; Zamiri et al., 2012). The mean length of stay was four days (Parker and Khateery, 2001). According to American association of Endodontic, systemic administration of the appropriate antibiotic usually ranges from five to seven days and the clinical findings of infections can be eliminated within two to four days after removal of the infection cause (Baumgartner JC and T., 2003).
However, Sandor GK et al recommended the use of Clindamycin which is a lincosamide (like the lincomycine), as first line therapy in odontogenic infection (Sandor et al., 1998) , justifying this by the failure of treatment with penicillin shown in some studies. Flynn and colleagues found a 26% failure rate of penicillin when used in a series of 34 hospitalized cases of odontogenic infection (Flynn et al., 1999). The choice for lincomycin in our study agrees with the Sanford Guide to Antimicrobial Therapy (Gilbert et al., 2009).
All types of antibiotics used in the current study were safe with no complications or side effect. Although it was not statistically confirmed by the current study, Lincomycine has been an effective alternative when the patient is allergic to penicillin. Pseu-

do-membranous colitis were not reported in patients treated with Lincomycin during this study.
Many laboratory tests were used to investigate the general condition of the odontogenic infection, patients to determine its influence over the clinical course and prognosis. white blood cells used as parameter for the severity score of the infection (Flynn et al 1999) ,WBC count, erythrocyte sedimentation rate and admission temperature are of monitoring value for the diseases progress (Dodson TB et al., 1989)
In this study, A significant negative correlation was observed between WBCC and duration of antibiotic use (p= -0.029). Despite that WBCC can be useful in assessing a patient's response to therapy, it is agreed that raised CRP could have more value in determining severity of infection (Bakathir et al., 2009; Unkila-Kallio et al., 1994; Ylijoki et al., 2001).This might be related to the slow reaction of WBC to bacterial infection (Unkila-Kallio Let al., 1994).
There was a negative correlation between Hb level and duration of drain in place, duration of antibiotic use and hospitalization was. However, it has not been statistically significant.

Conclusion
Early removal of the causative tooth and severity of trismus seem to influence the odontogenic infection management outcome in terms of duration of antibiotic use, duration of drainage and hospital stay.

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