Maxillofacial Infections of Odontogenic Origin: Epidemiological, Microbiological and Therapeutic Factors in an Indian Population

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Abstract Odontogenic fascial space infections are commonly encountered by the oral and maxillofacial surgeon. A retrospective study of the epidemiological characteristics, microbiological analysis and treatment response to odontogenic infections treated in the oral and maxillofacial unit of a Dental school is presented. A retrospective analysis of case records of all odontogenic infections that reported to the oral and maxillofacial surgery unit in a Dental school over a period of 2 years was performed. Epidemiological data, microbiological profile and treatment responses were analysed. All data were subjected to statistical analysis using SPSS statistical package. Mann–Whitney U test, Kruskal–Wallis test and nonparametric tests were carried out. A total of 2,140 patients were included in this study. Mandibular third molars were the offending tooth in nearly 40 % of cases with 107 patients becoming symptomatic following a dental extraction procedure. All patients were treated with surgical incision and drainage, antibiotics and local wound care. More than 95 % cases needed intraoral incisions. Penicillin was the drug in most of the cases. The pterygomandibular space was the most commonly involved with 15 % reporting with multiple fascial space involvement. Microbiological analysis showed a predominance of aerobic gram positive organisms with *Streptococcus sanguis* most commonly isolated. *Peptostreptococci* and *Propionibacterium* were the common anaerobes isolated. More than 80 % of the strains isolated were sensitive to penicillin. The average length of stay was 6.3 days. Inadequate documentation

with regards to referral patterns, antibiotic history was commonly observed in case records. Penicillin continues to remain the drug of choice for a vast majority of maxillofacial infections of odontogenic origin. A delay in reporting can lead to worsening of symptoms with consequent increase in surgical morbidity and costs of treatment. Preventive dental care remains the best option available to mitigate the consequences of poor oral hygiene. Poor awareness among patient population for regular dental reviews and oral hygiene maintenance emphasises the need for sensitisation and education programs.

Keywords Odontogenic infections · Incision and drainage · Pterygomandibular · Retrospective · Culture and sensitivity

Introduction

Maxillofacial infections of odontogenic origin are commonly encountered by the oral and maxillofacial surgeon. The acute dental abscess is frequently underestimated in terms of its morbidity and mortality [1]. The presentation of such infections can range from a simple vestibular swelling to life threatening complication such as sepsis and airway compromise and are among the most common dental emergencies reporting to the Emergency Room [2]. These infections are almost always secondary to necrotic pulpal tissue following a deep carious lesion. Often, such infections can also commence in the pericoronal tissue. While the advent of antibiotics has resulted in a diminished severity of odontogenic infections, such infections can sometimes be poorly managed and result in significant morbidity. Early recognition of symptoms and prompt treatment improve the overall outcome. Most patients need

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a surgical intervention either in the form of incision and drainage or with the removal of the offending tooth.

Materials and Methods

The Dept of Oral and Maxillofacial Surgery performed an audit of maxillofacial infections that reported to the Out-patient services of a dental school in South India over a 2 year period. A retrospective analysis of all case records of patients with maxillofacial infections was done to determine the clinical characteristics, microbiological profile and response to treatment provided. Those patients in whom an incision and drainage was not performed were excluded from the analysis. All the tabulated data were evaluated in Microsoft Excel Program and expressed in frequencies/percentages.

Results

A total of 2,140 patients (1,326 male, 814 female) aged between 3 and 78 years (mean age 35.2 years) were included in the analysis. Odontogenic etiology was seen in an overwhelming majority of cases with only a handful developing maxillofacial infections following embedding of foreign material after trauma. The mandibular third molar was the offending tooth in nearly 40 % of reported cases. Maxillofacial infection as a post dental extraction complication was seen in 107 patients.

The pterygomandibular and submandibular spaces were the most common fascial spaces encountered in this cohort with 15 % reporting with multiple fascial space involvement (Fig. 1). Incision and drainage through an intraoral approach was performed in 2,046 patients with the vestibular incision used in a vast majority of cases (93.5 %). Of the 94 extraoral incisions, the Risdon's submandibular incision was employed in 35 % of cases. Penicillin was the empirical drug of choice in all patients except in whom a history of allergy to penicillin was elicited wherein clindamycin was prescribed. Concomitant administration of metronidazole was recorded in only 8 % of cases.

Culture and sensitivity was performed in 88 patients with multiple fascial space involvement and with immunocompromised medical conditions. Aerobes were seen in 60 cases with a mixed polymicrobial profile in 12 patients. Among aerobic organisms isolated, 80 % were gram-positive cocci, 19 % were gram-negative bacilli, and one was a gram-positive bacillus. A similar picture was seen with anaerobes gram-positive cocci comprising 78.3 % and gram-negative bacilli 21.7 % of the culture isolates. Sterile cultures were observed in eight patients. While *Streptococcus sanguis* and *Streptococcus mitis* were the most

Fig. 1 Fascial spaces involved

frequently isolated aerobic strains, *Peptostreptococci* and *Propionibacterium* accounted for more than 85 % of the isolated anaerobic strains (Table 1).

Sensitivity testing to Penicillin revealed that 26 (81.3 %) were sensitive and 6 (18.8 %) were resistant. Of the six resistant strains, four were coagulase negative *Staphylococcus* and two were *Staphylococcus aureus*. Ninety four strains were tested against Clindamycin and showed sensitivity in 88, intermediate sensitivity in 2 and resistance in 4. Resistant strains belonged to *Peptostreptococci*, *Enterococcus faecalis* and *Streptococcus mutans*. Among the 86 strains tested for ciprofloxacin, 81.4 % (n = 70) were sensitive, 3.8 % (n = 5) exhibited intermediate sensitivity and 8.4 % (n = 11) were resistant. Three strains of *Streptococcus mitis* and two each of *Peptostreptococci* and *S. sanguis* were the resistant strains. Sixty one strains were tested for sensitivity to cefotaxime and more than 90 % (n = 56) showed sensitivity along with three strains of *Peptostreptococci* and one strain of *Pseudomonas* demonstrating resistance.

Inpatient admission (n = 42) was generally limited to those patients with multiple fascial space involvement, impeding airway obstruction and immunocompromised medical conditions. Patients generally reported first on an average of 5 days after the initial presenting symptom. The average length of stay (LOS) of hospitalized patients was 6.3 days with 32 patients reporting with the involvement of three or more fascial spaces.

Discussion

Mandibular third molars have been identified as the most common source of maxillofacial infections of odontogenic origin [3]. There has been an increased rate of mandibular third molar impaction in Western society, attributed to better preventive dental care and absence of a premature loss of the mandibular first or second molar by dental caries. The combination of poorly oxygenated pericoronal

Table 1 Frequency of organisms isolated

Organisms isolated	Frequency
Anaerobic (n = 23)	
<i>Actinomyces</i> spp.	1
<i>Bacteroides</i> spp.	1
<i>Peptococcus</i> spp.	1
<i>Peptostreptococci</i> spp.	16
<i>Propionibacterium</i> spp.	4
Aerobic (n = 100)	
<i>Acinetobacter baumannii</i>	2
<i>Acinetobacter iwoffii</i>	1
<i>Alpha hemolytic streptococci</i>	3
<i>Arcanobacterium hemolyticum</i>	3
<i>Beta haemolytic streptococci</i>	8
<i>Citrobacter freundii</i>	1
<i>Citrobacter diversus</i>	2
<i>Coagulase negative staphylococcus</i>	6
<i>Corynebacterium</i> spp.	1
<i>Escherichia coli</i>	3
<i>Enterobacter agglomerans</i>	1
<i>Enterobacter</i> spp.	2
<i>Enterococcus faecalis</i>	10
<i>Enterococcus</i> spp.	2
<i>Klebsiella pneumoniae</i>	6
<i>Microaerophilic streptococcus</i>	1
<i>Non group A beta hemolytic streptococci</i>	1
<i>Pseudomonas aeruginosa</i>	1
<i>Staphylococcus aureus</i>	4
<i>Streptococcus mitis</i>	15
<i>Streptococcus mutans</i>	2
<i>Streptococcus pyogenes</i>	1
<i>Streptococcus salivarius</i>	4
<i>Streptococcus sanguis</i>	18
<i>Streptococcus species</i>	1
<i>Streptococcus viridans</i>	1

flap and entrapment of food particles serves as an excellent medium for oral microorganisms [4]. Odontogenic infections of the mandibular third molar can spread rapidly owing to the anatomical location of this tooth at the crossroads of the masticator, submandibular, and buccal fascial spaces with adjacent anatomical access to contiguous pterygomandibular, parapharyngeal, parotid, submandibular and other spaces [5]. The same potentially serious sequelae exist as post extraction complications, emphasizing the importance of assessing the risk/benefit ratio and medicolegal implications.

The establishment of surgical drainage is the cardinal principle in the management of acute dentoalveolar infections [6]. Some surgeons may fear that surgical intervention in cellulitis may worsen the condition and proceed

with drainage only in the presence of an abscess. This fear is unfounded and irrational as the presence of pus is partly dependant on the stage of the infective process, microorganism involved and the degree of host resistance. Drainage should be considered in both cellulitis and abscess. With mandibular molars accounting for a majority of odontogenic infections, the Risdon's submandibular incision is the most popular approach as it provides access to explore all contiguous fascial spaces, viz, submandibular, buccal, pterygomandibular, submasseteric and lateral pharyngeal spaces. The Sicher's incision though precludes an external scar, fails to provide dependant drainage of above fascial spaces and is of limited value in the presence of trismus [7].

Patient assessment to determine the need for adjunctive systemic antibiotic therapy also plays a vital role. Ideally the antibiotic chosen should be based on the result of culture and sensitivity testing. However, this information is not available for several days and some delay (common in settings with limited manpower) in delivery of specimens to the laboratory may jeopardise the findings. Current guidelines suggest that there is a minimal role for routine culture and sensitivity testing in maxillofacial infections of odontogenic origin [8]. Patients with rapidly spreading infections, immunocompromised conditions and recalcitrant, recurrent infections are candidates for culture and sensitivity testing. This explains the reason as to why only 88 patients underwent culture and sensitivity testing. For all practical purposes, an antimicrobial agent is usually prescribed empirically. Penicillin group of antibiotics, with an antimicrobial activity suited to the oral cavity, low incidence of adverse events and cost effectiveness has long been the first choice for dental infections. Amoxicillin and Ampicillin provide cover for enteric gram negative bacilli with the former more popular owing to its superior enteric absorption. It has been reported that the emergence of antibiotic-resistant bacteria correlates with the overuse, abuse and misuse of antibiotics [9]. However, clinical observations indicate that the presence of penicillin-resistant strains in mixed microflora of odontogenic maxillofacial infections does not adversely affect the outcome of treatment where penicillin is prescribed as an adjunct to surgical drainage [10, 11]. Findings of a clinical audit reveal that antibiotics prescribed by both physicians and dentists tended to be inappropriate and suboptimal [12]. Often, the medications were prescribed either as a substitute for operative intervention of a dental infection, or as an adjunct, despite the absence of any signs of systemic involvement. Such irrational drug prescriptions expose patients to risk of anaphylactic reactions, development of potentially fatal odontogenic infections, destruction of commensal flora with consequent selection and overgrowth of resistant "super-bug" organisms. Promoting a rational

antibiotic prescription is one of the top priorities for health administrators all over the world with the advent of multiple resistant microorganisms.

The LOS has consequences on health economics, bed occupancy and manpower needs [13]. LOS can be predicted by the number of infected spaces, admission temperature and underlying medical conditions [14]. While the average LOS in this study was 6.3 days, almost all patients who needed admission reported to this Unit only after an average of five or more days by which they had presented with progression of the infection and a worsening of symptoms.

This retrospective audit showed inadequate recording of clinical data in patient case sheets. Often, important information such as associated medical conditions, referral patterns, details of previous antibiotics administration were scant in detail. Residents and junior consultants must be sensitised to the importance of proper and adequate documentation. Diligent documentation can facilitate future research and audit activities to improve efficiency of care delivered to patient population. Consultants must regularly ensure that clinical notes are in order. Close communication with patients and relatives until resolution of the health problem for which they sought care is obvious. Consultation with other health professionals and recognition of the rapidity with which the oropharyngeal airway can be compromised by a regional infection are important for all clinicians. The philosophy of “never let the sun set on pus” is an apt mantra to follow.

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