

# Steroids in Maxillofacial Space Infection: A Retrospective Cohort Study

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## Abstract

Maxillofacial space infection (MSI) is one of the most common conditions encountered in oral and maxillofacial surgery clinics. Early recognition and proper management of MSI could prevent a life-threatening event. **Objectives:** To report a series of MSI managed with antibiotics, surgical intervention and exogenous steroids as an adjunct, highlighting functional improvement following steroid administration. **Methods:** A retrospective cohort study was carried out from December 2013 to September 2016, involving 30 patients (n = 30, 22 males, 8 females) diagnosed with MSI. All patients were initially managed with intravenous empirical antibiotics, analgesics and removal of potential source of infection. A course of 3 doses of IV Dexamethasone 8 mg at an interval of 8 hours was started during the first day of hospital admission. **Results:** This series reports 30 patients presenting with MSI, who received prompt antibiotics and 3 doses of steroids as in-patients. Significant clinical improvement was noted in the form of amelioration of pain, rapid reduction in edema, and improved trismus, shortening hospital stay to an average of 3.5 days, and omission of surgical intervention in 50% of our cases. No adverse effects or drug reaction was noted. **Conclusion:** In conclusion, the value of synergistic use of corticosteroids with antibiotics in management of MSI is significant. Despite these promising findings, there is scarce evidence in the literature to fully support the use of corticosteroids in abscess management. The role of corticosteroids in treatment of MSI should be explored further.

## Keywords

Maxillofacial Space Infections, Abscess, Odontogenic Infections, Systemic Steroids, Adjunctive Management

## 1. Introduction

Maxillofacial space infection (MSI) refers to infection in the potential spaces and

fascial planes of the maxillofacial region, a region with a complex anatomy [1]. MSI accounts for one of most common dental-related attendances at emergency departments. The main etiologies of MSI are odontogenic infection, lymphadenitis, and trauma [2], with odontogenic infection accounting as a major contributor. A nationwide Emergency Department survey of 450 hospitals in 27 US states in 2007 showed 302,507 visits attributed to facial cellulitis from dental origin [3]. Severe odontogenic infection remains an important public health concern and has become a significant economic burden to public health care facilities. A retrospective study done by Jundt JS *et al* (2012) on 42 patient records of inpatients treated for odontogenic infections reported a cost of \$749,382 averaging \$17,842 per person [4]. Another nationwide inpatient sample taken in 2008 from 1056 hospitals in 42 US states shows 4044 hospital discharges with a primary diagnosis of mouth abscess/cellulitis, accounting for \$98 million of hospitalization charges at a mean hospital charge of \$24,240 per patient [5].

MSI carries significant risk of morbidities and mortality. Late, incorrect or non-treatment could lead to life-threatening complications, such as airway compromise [1] [2] [4] [6]-[13], descending necrotizing mediastinitis [1] [2] [6]-[18], Lemierre syndrome [7] [11] [12], carotid artery erosion and rupture [7], pericarditis [7], brain abscess [19] [20] [21] [22], cavernous sinus thrombosis [23] [24], meningitis [25], thoracic and abdomino-perineal extension of abscess [26], necrotizing fasciitis [13] and sepsis [1] [2] [4] [6] [7] [10] [13] [15]. In the pre-antibiotic era, odontogenic infections were associated with a mortality rate of 10% - 40% [27]. The advent and implementation of modern antibiotics have significantly reduced mortality rates associated with odontogenic infections [4].

Treatment of MSI involves early recognition and correct diagnosis, prompt initiation of antibiotic therapy, removal of potential source of infection with or without surgical intervention.

Usual clinical presentations of MSI include swelling, trismus, pain, odynophagia, and dysphagia, which are partly attributed to inflammatory component that accompanies infection. This inflammatory response is sometimes responsible for an exaggerated clinical presentation. Corticosteroids have been used to treat edema and inflammation in various head and neck diseases [28]. We therefore postulated that corticosteroids may also have a beneficial role in the management of MSI. The present study offers a retrospective cohort analysis of MSI patients treated in Department of Oral and Maxillofacial Surgery, Hospital Sultanah Nora Ismail (Batu Pahat, Johor, Malaysia) managed with antibiotics, surgical intervention and exogenous steroids as an adjunct, highlighting functional improvement following steroid administration.

## 2. Materials and Methods

A retrospective cohort study was done, involving the consecutive inclusion of patients with MSI treated in our unit (Oral and Maxillofacial Surgery Unit, Hospital Sultanah Nora Ismail, Batu Pahat, Malaysia) from December 2013 to Sep-

tember 2016. The study sample involves 30 patients.

**Inclusion criteria:**

1) Patients with maxillofacial space infection requiring hospital admission. Criteria for hospital admission include: Trismus, fever, dysphagia, odynophagia, dyspnoea and/or worsening general condition

2) Patients who complied to required stay in ward

**Exclusion criteria:**

1) Patients who were diabetic, anaemic, or with history of possible gastrointestinal ulcerative disease

2) Patients who were not compliant to required stay in ward

3) Patients with compromised host defences

a) Patients who are on immunosuppressive/cytotoxic therapy

b) Patients with diseases that compromise their immunity (e.g. AIDS, Leukemia etc.)

The basic diagnostic protocol included anamnesis, examination of oral cavity/ infection site and the use of imaging techniques (intraoral periapical radiographs, occlusal radiographs, or orthopantomogram) to achieve the diagnosis. Laboratory tests were also requested: full blood count for all cases, and other tests according to case based needs.

Management protocol was based on intravenous antibiotic treatment along with adjunctive steroids, with or without surgical intervention. All patients were initially managed with intravenous empirical antibiotics (IV Augmentin 1.2 gm TDS or IV Unasyn 1.5 gm TDS), analgesics (Tab Ibuprofen 400mg or IM Voltaren 400 mg or IM Tramal 50 mg TDS) and removal of potential source of infection. A course of 3 doses of IV Dexamethasone 8 mg at an interval of 8 hours was started during the first day of hospital admission after obtaining a full blood count with parameters within normal range. Surgical intervention was considered in cases requiring drainage of underlying collection, and in some cases a drain was placed in situ for several days to enable continued drainage.

Demographic data collected were patient age, gender, ethnicity, and parameters relating to medical history. Specific outcomes were measured: number of anatomic spaces involved, changes in mouth opening and swelling size, length of hospital stay and need for surgical intervention. All MSI patients treated in this unit, from December 2013 to September 2016, are identified from patient registry following inclusion criteria and exclusion criteria stated. Patients' clinical records are then reviewed and demographic data and specific outcomes are recorded in data collection form. All data and information collected were tabulated and arranged electronically (Microsoft Excel spreadsheet) and analysed descriptively.

### 3. Results

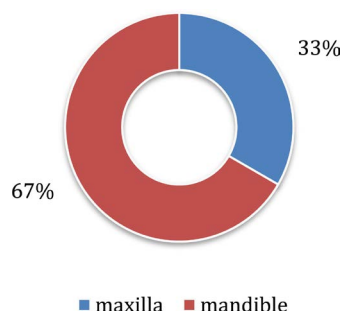
A total of 30 patients were reviewed based on the inclusion criteria, 22 of which male and 8 female. Only 2 pediatric patients, ages 6 and 7 years old, were treated.

The mean age of the group was 32.1 years [Table 1]. Mandible (67%) was more frequently involved than maxilla (33%) [Figure 1]. Involvement of the left side (50%) was slightly more than right (40%), whereas 1% of infections were

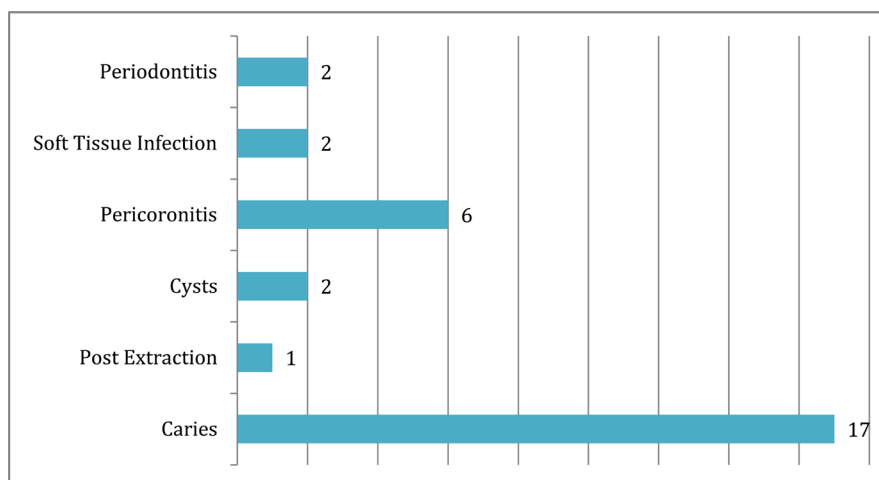
**Table 1.** Demographic data of patients.

Case	Age	Sex	Anatomic space	LOS (days)	Surgical intervention (I & D)	Change in swelling size (cm)	Change in mouth opening (cm)
1	30	M	SM	4	√	3	1
2	17	M	SMen	3	×	3	1.5
3	33	M	B	4	√	2.5	0.5
4	22	M	B	3	×	2	-1
5	52	F	C	3	√	2	0
6	28	M	B	3	√	3	-2.5
7	29	M	SMass	4	√	3.5	-1
8	20	M	B, SM	3	√	4	0.5
9	6	F	C	5	√	4	0.5
10	17	M	C	4	√	2	0
11	26	M	C	4	√	4	0.5
12	30	F	C	3	×	2	0
13	38	F	B	2	×	1.5	1
14	38	M	B	3	√	4	2
15	48	M	C	2	×	3	0.5
16	20	F	SM	3	×	4	1.5
17	68	M	B, SM	3	×	3	0.5
18	36	M	B	3	√	4	0
19	25	M	SM	4	√	3	1.5
20	7	M	B,C	4	×	6	0
21	34	M	B	2	√	5	0.5
22	52	F	SL, SMen, SM	4	×	2	1.5
23	18	M	C	3	×	2	-0.5
24	37	F	SM,B	3	√	2	0
25	55	M	B,C	4	×	4	0.5
26	24	M	B	3	×	2	0.5
27	53	M	B, Smass	7	√	4	1
28	27	M	SM	3	×	4	0.5
29	37	M	SL, SMen, SM	4	×	1	2
30	37	F	SM	4	×	3	1

LOS, length of stay; I & D, incision and drainage; SM, submandibular; SMen, submental; SMass, submasseteric; SL, sublingual; B, buccal; C, canine.



**Figure 1.** Site of involvement of MSI.



**Figure 2.** Distribution of patients according to identified source of MSI.

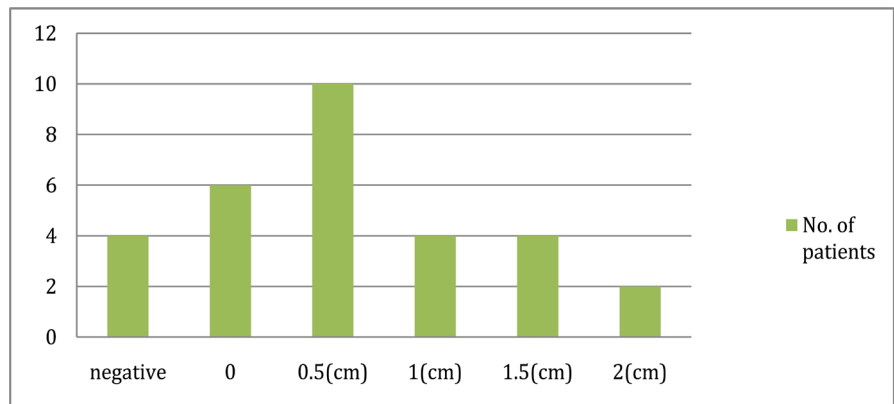
recorded as bilateral. 30% of patients presented with involvement of more than one anatomical space [Table 1].

Regarding the etiology of MSI, most frequent cause was dental caries (17 patients, representing 56% of recorded cases), followed by pericoronitis (6 patients, 20%), cysts, periodontitis and soft tissue injury (2 cases each, 6.6% each) and post extraction (1 patient, 3%) [Figure 2].

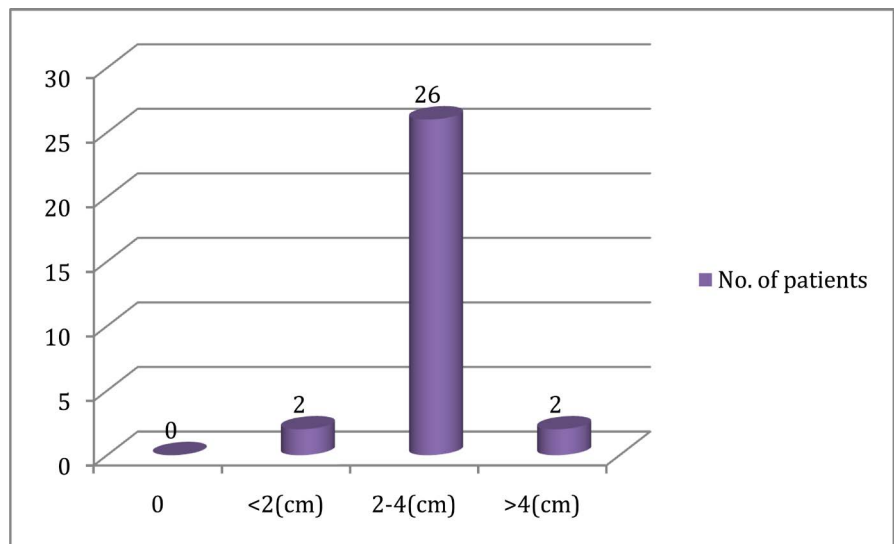
Of the total study sample, incision and drainage under local anesthesia was done for 50% of the patients. The average length of stay in the hospital was 3.46 days. In terms of improvement in trismus (0 - 24 hours post steroid administration), a majority (33%) of patients showed 0.5 cm increase in mouth opening, maximum improvement is of 2 cm (6.6%). However, 13% of patients had reducing mouth opening and 20% showed no significant change [Figure 3]. 86% of patients showed a 2 - 4 cm reduction in swelling size (0 - 24 hours post steroid administration), whereas 6.6% showed improvement of more than 4cm and less than 2 cm respectively [Figure 4].

#### 4. Discussion

Traditionally, treatment of MSI involves prompt initiation of antibiotic therapy, with or without surgical intervention. Despite this, patients sometimes fail to improve, or even worse, deteriorate further. This is particularly observed in cases



**Figure 3.** Changes in mouth opening post steroid administration.



**Figure 4.** Changes in swelling size post steroid administration.

of Ludwig's angina. Delayed or lack of clinical improvement has been attributed by some authors, to a deficiency in host defence mechanism. The rationale of employing exogenous corticosteroids is to augment the body's natural defense response to combat infection in conjunction with antibiotic administration [29].

This unit treats an average of 100 to 120 MSI patients annually. Patients presenting with acute MSI with risk of rapid progression to Ludwig's angina or orbital cellulitis, were given adjunctive steroids (abiding exclusion criteria) along with broad-spectrum antibiotics. Significant clinical improvement was noted in the form of amelioration of pain, rapid reduction in edema (as shown in **Figures 5-8**), and improved trismus, shortening hospital stay to an average of 3 to 4 days, and omission of surgical intervention in 50% of our cases. In comparison, patients whom steroid administration was contraindicated have shown relatively slower clinical improvement and longer hospital stay (5 - 6 days). Case number 6, 8, 9, and 25 showed reduction in mouth opening post Dexamethasone administration, this is likely attributable to post surgical edema following surgical removal of causative tooth.



**Figure 5.** Case number 18; Day 1 to day 3 (from left to right).



**Figure 6.** Case number 10; Day 1 to day 3 (from left to right).



**Figure 7.** Case number 15; Day 1 to day 2 (from left to right).



**Figure 8.** Case number 5; Day 1 to day 2 (from left to right).

These clinical parameters of disease improvement are markedly discernable following administration of one/two doses of Dexamethasone, attributable to the known anti-inflammatory and anti-edematous effects of corticosteroids. Corticosteroids inhibit transcription of pro-inflammatory mediators in human airway endothelial cells that cause pharyngeal inflammation and ultimately symptoms of pain [30] [31]. Lamkin and Portt (2006) reported that there was a striking degree of synergy between antibiotics and steroids in the treatment of various head and neck infections [32].

Some may argue that systemic corticosteroids could suppress body's natural immune response, potentially worsen the existing microbial infection sequelae.

However, a regimen of short termed corticosteroids (3 doses at an interval of 8 hours) is unlikely to result in suppression of host immune response.

Many authors are advocating the use of systemic corticosteroids in the management of peritonsillar abscess and acute pharyngitis based on the promising findings from systemic review of relevant studies and clinical trials [30] [33] [34] [35] [36]. However, the role of corticosteroids in management of MSI has not been extensively studied [29] [37].

The ideal evidence to justify the conclusion that steroids improve the outcome in maxillofacial space infection management would be a study, which shows a clear comparison between 2 groups (group which receives intravenous antibiotics along with adjunctive steroids versus group which receives intravenous antibiotics without adjunctive steroids). However, as most retrospective studies, data of patients are often not complete. The comparison between steroids versus non-steroids group would be difficult and biased (Steroids are not given to diabetic patients in our centre, and comparing the 2 groups would further skew the results as most diabetic patients have poorer recovery). On the other hand, steroids are given as a first line adjunctive treatment in low-risk patients in this centre, hence the confounding factors of surgical intervention and antibiotics could not be negated.

## 5. Conclusion

In conclusion, the value of synergistic use of corticosteroids with antibiotics in management of MSI is significant. Despite these promising findings, there is scarce evidence in the literature to fully support the use of corticosteroids in MSI management. The role of corticosteroids in treatment of MSI should be explored further.

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## Conflict of Interest

None declared.

## Consent

Informed consent was obtained from the patients for publication and any accompanying images.

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