

# Factors associated with prolonged hospitalizations from odontogenic infections in children

Michael V. Joachim\*/ Mary Abdo\*\*/ Kutaiba Alkeesh\*\*\*/ Orit Oettinger-Barak\*\*\*\*  
/ Said Abozaid\*\*\*\*\*/ Imad Abu El-Naaj\*\*\*\*\*

**Objective:** Oro-facial infections are common pathologies comprising a substantial health concern in the pediatric population. Incorrect or late treatment may lead to serious and possibly life-threatening complications. The aim of this study is to analyze variables associated with prolonged length of hospital stays (LOS) due to odontogenic infections in children. **Study design:** Data was collected from the records of patients (age <15 years) hospitalized due to odontogenic infections at Poriya Medical Center during the period of 1/2010–12/2015. Patients with oro-facial infections originating from other organs were excluded from the study as well as children with underlying systemic medical conditions that may affect recovery. **Results:** A total of 411 patients (mean age  $6.5 \pm 2$  years) were included in this study, with 58.4% being male. There were significantly higher ( $p < 0.05$ ) values of white blood cell (WBC) counts in patients with >3 days LOS. Patients with >3 days LOS were also significantly older (8.4 vs. 6.3 years). There were no significant differences in sex distribution or other clinical or laboratory parameters between the groups. **Conclusion:** Older child age and higher WBC counts on admission are indicators for prolonged LOS.

**Keywords:** Tooth infections, Pediatric hospitalization, Odontogenic infections

## INTRODUCTION

Oro-facial infections are common pathologies in the pediatric population<sup>1–6</sup>. These infections are classified as odontogenic and non-odontogenic; the former originate from the teeth and their supporting structures and may be caused by caries, pericoronitis, gingivitis, trauma and iatrogenic factors<sup>7–9</sup>. Clinical signs of oro-facial infections include local pain, swelling, redness and occasionally leukocytosis and elevated C-reactive protein (CRP)<sup>10</sup>.

The oral microbiota is complex, consisting of more than 500 different bacterial species<sup>11,12</sup>. Odontogenic infections are poly-microbial by nature, and the microbial composition varies within time and the establishment of the inflammatory lesion<sup>5,9,13–15</sup>. These infections usually involve both aerobic and anaerobic bacteria, dominated by the anaerobic bacteria load being two times higher than the aerobic load<sup>11–13,16–19</sup>.

The mechanisms initiating poly-microbial infections are not clear yet. It is assumed that a pathological metabolic cooperation exists between the pathogens so that each component has a role in the infectious process<sup>20</sup>. Synergism allows these pathogens to avoid the host's immune system responses concomitantly with a rise in their virulence<sup>21,22</sup>.

Treatment of odontogenic infections aims to eradicating the source and may include endodontics, excision and drainage of abscesses, extraction of involved teeth, and oral or intravenous antibiotics. The choice of treatment is affected by sev-

\*Michael V. Joachim, DMD, MSc, Resident, Department of Oral & Maxillofacial Surgery, Baruch Padeh Medical Center, Poriya and Azrieli Faculty of Medicine, Bar-Ilan University, Safed, Israel.

\*\*Mary Abdo, MD, Attending, Department of Pediatrics, Baruch Padeh Medical Center, Poriya, Israel.

\*\*\*Kutaiba Alkeesh, DMD, Department of Oral & Maxillofacial Surgery, Baruch Padeh Medical Center, Poriya, Israel.

\*\*\*\*Orit Oettinger-Barak, DMD, PhD, MSc, Senior Lecturer, Melbourne Dental School, Melbourne, VIC, Australia.

\*\*\*\*\*Said Abozaid, MD, Head, Department of Pediatrics, Baruch Padeh Medical Center, Poriya, Israel.

\*\*\*\*\*Imad Abu El-Naaj, DMD, Chief Surgeon and Head, Department of Oral & Maxillofacial Surgery, Baruch Padeh Medical Center, Poriya, and Azrieli Faculty of Medicine, Bar-Ilan University, Safed, Israel.

### Corresponding Author:

Michael V. Joachim,  
Department of Oral & Maxillofacial Surgery, Baruch Padeh Medical Center,  
Poriya and Azrieli Faculty of Medicine, Bar-Ilan University,  
Safed, Israel. M.P. Lower Galilee, Israel.  
ZIP: 1520800.  
Phone: +97246652254  
Fax: +97246652720  
E-mail: michael.joachim@biu.ac.il

eral diagnostic variables, and is based mainly on the nature of the involved teeth (the decision to extract a primary tooth is easier than for permanent teeth), systemic factors involved (background illness that might affect immune response), abscess formation, age, and compliance of the patients<sup>4</sup>. However, if the abscess involves larger areas or if there are signs of systemic infections, administration of antibiotics is recommended<sup>5,7,9</sup>.

Severe odontogenic infections form a significant public health concern. Early diagnosis and management of orofacial infections in children is crucial for preventing serious complications such as airway obstruction, Ludwig's Angina, sepsis and cavernous sinus thrombosis (CST)<sup>8,13,23,24</sup>.

The aim of this study is to analyze factors associated with prolonged length of stay (LOS) pediatric hospitalization due to odontogenic infections in the department of Oral and Maxillofacial Surgery at Baruch Padeh Medical Center.

## MATERIALS AND METHODS

Data was collected from files of children under the age of 15 years hospitalized for odontogenic infections in the department of Oral and Maxillofacial Surgery at the Baruch Padeh Medical Center, Poriya, between the years 2010–2015.

Patients with oro-facial infections originating from other organs were excluded from the study as well as children with underlying systemic medical conditions that may affect recovery, such as immunodeficiency syndromes and diabetes. The data collected included: age, gender, cause of hospitalization, involved tooth/teeth, pre-admission antibiotic treatment, treatment modality (antibiotics, extraction, drainage), length of stay (LOS), white blood cell counts (WBC), platelet counts, neutrophil counts and C-reactive protein (CRP) on admission.

Patients hospitalized for three days or more were compared to those being hospitalized for two days or less.

The data was collected using Excel™ (Version 16, Microsoft, Redmond, WA, USA) spreadsheet and statistical analysis was conducted with Two-tailed Fisher's exact, Chi-square and *t*-tests. A *p*-value of 0.05 was considered statistically significant.

This study was approved by the Institutional Review Board (IRB) of the Baruch Padeh Medical Center (#0093-15-POR). Approval included exemption from getting patients' informed consent.

## RESULTS

A total of 411 files of patients under the age of 15 hospitalized for odontogenic infections were included in the study (Table 1). 58.4% of the patients (240) were male (Table 1). The mean age was 6.5 ± 2.5 years (range 1–14 years). Over 97% of the cases were hospitalized with swelling, 50.6% originating from a maxillary tooth. Primary molars were involved in 79.4% of the cases, with the second primary molars being most prevalent. Only 20.4% of the patients presented with fever above 38 °C on admission (Table 2).

The clinical data gathered upon admission reveals that the majority of patients (57.2%) were treated with antibiotics prior

**Table 1: Characteristics of patients.**

	Number	%
Gender		
Female	171	41.6
Male	240	58.4
LOS (days)		
1	205	49.9
2	153	37.2
≥3	53	12.9
Total	411	100.0

*Abbreviations: LOS—Length of stay in the hospital.*

**Table 2: Clinical data on admission.**

	Number	%
Prior AB use		
None	176	42.8
Unknown	56	13.6
Amoxicillin	96	23.4
Amoxicillin + Clavulanate	77	18.7
Azithromycin	2	0.5
Cefuroxime	2	0.5
Cephalexin	2	0.5
>38 °C on admission		
No	327	79.6
Yes	84	20.4
Productive drainage		
Yes	208	50.6
No	161	39.2
Unknown	42	10.2

*AB—Antibiotics.*

**Table 3: Clinical data during hospitalization and discharge.**

	Number	%
AB in hospital		
Amoxicillin + Clavulanate	402	97.8
Clindamycin	9	2.2
AB after discharge		
Amoxicillin + Clavulanate	343	83.5
Amoxicillin	20	4.9
Cefuroxime	3	0.7
Azithromycin	1	0.2
Clindamycin	4	1.0
No data	40	9.7
Re-admission		
No	392	95.4
Yes	19	4.6

*AB—Antibiotics.*

to admission, the most common being penicillin (42.1%)—mostly Amoxicillin (23.4%) followed by Amoxicillin Clavulanate (18.7%) (Table 2).

During hospitalization, the vast majority of patients (97.8%) were treated with intravenous Amoxicillin Clavulanate (Table 3), while the other 9 patients (2.2%) were treated with intravenous Clindamycin due to known Penicillin allergy (Table 3).

**Table 4: Variables that may affect length of stay.**

		1–2 days LOS	>3 day LOS	95% CI of difference	<i>p</i> value	test
Sex	M (%)	58.40	58.50		1.00	Fisher's exact test
	F (%)	41.60	41.50			
Age (years)	mean	6.28	8.36	1.36–2.80	<0.001	<i>t</i> -test
	SD	2.49	2.48			
WBC ( $\times 10^6$ /mL)	mean	11.56	12.61	0.19–1.91	0.02	<i>t</i> -test
	SD	3.48	2.81			
Neutrophils (%)	mean	0.80	0.73	(–0.89)–0.75	0.86	<i>t</i> -test
	SD	2.99	0.08			
CRP (mg/L)	mean	42.11	56.09	(–39.81)–11.84	0.28	<i>t</i> -test
	SD	34.78	29.22			
Platelets ( $\times 10^3$ /mL)	mean	338.61	314.00	(–1.18)–50.42	0.06	<i>t</i> -test
	SD	89.67	70.70			
Fever $>38^\circ\text{C}$	No (%)	81.00	69.80		0.07	Fisher's exact test
	Yes (%)	19.00	30.20			

LOS—Length of stay in the hospital; M—Male; F—Female; SD—Standard Deviation; CI—Confidence interval.

97.7% of cases were also treated by extraction of the involved tooth/teeth and drainage (either as a consequence of extraction or as a separate procedure). One percent of patients were treated solely by incision and drainage, without extraction. Fifty-one percent of the treated cases produced pus. The mean hospitalization time was  $1.7 \pm 0.9$  days, with 87.2% of the patients hospitalized for 1–2 days and 12.8% admitted for over 3 days. All patients were prescribed antibiotics for the post-discharge period, with 83.5% of patients receiving Amoxicillin Clavulanate (Table 3). The re-admission rate was 4.6%.

Comparison of results between the LOS 1–2 days and  $>3$  days LOS groups (Table 4) revealed a statistically significant difference in the mean age between the groups ( $p < 0.001$ ), with the  $>3$  days LOS group having a mean age of  $8.36 \pm 2.48$  years compared to  $6.28 \pm 2.49$  years for the LOS 1–2 days group (almost two years older). Additionally, WBC counts on admission were significantly higher in the  $>3$  days LOS group. The difference in the platelets counts between the LOS groups did not reach statistical significance ( $p = 0.06$ ).

There was no significant association between LOS and gender, source of infection or treatment type. There were no significant associations between LOS and  $>38^\circ\text{C}$  body temperature on admission on Fisher's exact test (Table 4). The Odds Ratio (OR) for prolonged stay and having  $>38^\circ\text{C}$  on admission was 1.83 (95% Confidence Interval (CI) 0.96–3.51,  $z = 1.865$ ), though not significant ( $p = 0.06$ ).

## DISCUSSION

Few reports have described the relationships between patients' gender and the incidence of odontogenic infections. In this study, males accounted for 58.7% of children hospitalized

for odontogenic infections, which is in agreement with previous reports having 51–66% male predominance<sup>5,7,15,24–27</sup>.

This study there was also no difference in the prevalence of maxillary mid-face infections compared to those with mandibular origin. Previous studies reported that upper jaw infections tend to be more prevalent in younger patients and present serious symptoms, while lower jaw infections are associated with older age and relatively ordinary pathogens<sup>7,26,28–34</sup>. Our study also found that primary molars were involved in 79.4% of the cases, with the second primary molars being most prevalent; this is in agreement with previous studies reporting the first primary molars as being the most common source of infection<sup>4,5,24</sup>.

The LOS in this study ( $1.7 \pm 0.9$ ) was relatively short, compared to previous reports ranging between 1.8–5.9 days<sup>5,7,24,27,29,31,32</sup>. These differences could be attributed to the excellent availability of operating rooms in our Medical Center. Since our post-operative process is similar to that reported in other studies, the short LOS may be due to the early surgical intervention facilitated by our OR availability. This phenomenon was previously described in studies looking at the financial burden of odontogenic infections<sup>35,36</sup>.

The mean age in our study is in agreement with previous reports, and falls in the middle of the range<sup>7,10,24,27,29</sup>.

Pre-hospitalization antibiotics used were mostly Penicillin based drugs, as described and recommended in previous reports<sup>5,9,37,38</sup>. As for antibiotics administered during hospitalization, our protocol is to use Amoxicillin-Clavulanate as the drug of choice, unless the patient has a verified penicillin allergy. Other reports described the usage of Clindamycin primarily, with Penicillin-based drugs used in less than 20% of the cases<sup>5</sup>. Both treatment modalities are equally recommended and there is no evidence of superiority of one treat-

ment over the other<sup>38,39</sup>.

Older children in our study had a significantly longer LOS than younger ones. This finding may be due to a worse condition at presentation in older children, *i.e.*, severer infections and abscesses that have developed over a longer period of time, which may lead to slower recovery. This phenomenon was not reported previously<sup>29</sup>.

Notably, the WBC count on admission was significantly higher in the prolonged LOS group, although the means were within the normal range of WBC counts and consistent with previous reports<sup>18,26,29,35</sup>.

## CONCLUSIONS

The results of the current study revealed interesting and important information about pediatric odontogenic infections as presented in our department.

This study demonstrates that hospitalization due to dental infections is more prevalent in male population and that prolonged hospitalization occurs in relatively rare occasions. As for factors affecting hospitalization length, older children tend to have severe infections and thus, longer length of stay in the hospital, as well as higher WBC counts on admission.

It is important to notice that this study demonstrates that high operating rooms availability may lead to shorter LOS and subsequently reduces economic burden due to dento-facial infections-related hospitalization.

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## CONFLICT OF INTEREST

None

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