Intravenous Clindamycin and Ampicillin Sulbactam Efficacy in Odontogenic Facial Cellulitis

Colton Fowlkes, DMD[1] , Michael Minyard, DMD[1], MPH, Brittany Waters, DMD[1,2], J C Shirley DMD, MS, MSc[1,2]

1 – Division of Dentistry, Children's Healthcare of Atlanta, 2- Department of Pediatrics, Emory University School of Medicine

BACKGROUND

In the United States, dental caries is the most prevalent chronic disease in the pediatric population[1]. Approximately 52% of children ages 6-8 were diagnosed with dental caries with roughly 16% of children in this age group having untreated dental caries[1]. Dental caries can lead to a myriad of issues if left untreated, including dental pain, facial swelling, and a decreased quality of life by inhibiting everyday activities like eating, drinking, and speaking. Definitive caries treatment leads to missed school days for children and workdays for parents, and, in some instances when left untreated, hospital admission if dental caries progresses to facial cellulitis. In 2014, it was noted that 80% of non-dental trauma related emergency department visits could be linked to dental caries[2]. When children are seen in the emergency department for dental caries, analgesics and antibiotics are commonly prescribed. Although patients discharged from emergency departments are frequently prescribed antibiotics, it should be noted that solely prescribing antibiotics is against recommendations without definitive dental treatment[3,4]. Intravenous antibiotics can be administered when dental caries leads to facial cellulitis and can lead to early definitive dental treatment[3]. A decreased hospital duration may be observed when dental extractions can be completed earlier in pediatric patients diagnosed with facial cellulitis of odontogenic origin[5]. Proper diagnosis and management of odontogenic infections by administering appropriate antibiotics and timely dental treatment can lead to expedited recovery[6].

Figure A illustrates a pediatric male patient with right sided facial cellulitis of odontogenic origin.

There are a multitude of pharmacologic decisions that are made when administering antibiotics, including type of antibiotic, route of administration, duration and frequency of antibiotic therapy, and dosage throughout treatment. Amoxicillin has historically been considered the standard of care in the treatment of odontogenic infections, however, as penicillin resistance has increased due to bacterial resistance and beta lactamases, other pharmacologic options have been researched and recommended accordingly[7,8]. Clindamycin has been suggested as an alternative first line pharmacologic agent due to its resistance to beta lactamase degradation in addition to its good oral bioavailability and presence in bone[7,8]. Multiple studies illustrate the similar efficacy of amoxicillin/clavulonic acid and clindamycin in treating odontogenic infections with comparable safety[9,10]. The incidence of *C.difficile* infections associated with clindamycin usage has been well documented and should be taken into consideration when prescribing antibiotics[11]. In addition to clindamycin, ampicillin sulbactam has also been identified as a viable alternative to be considered instead of amoxicillin[12]. Ampicillin sulbactam in addition to surgical intervention is a good standard in treating severe odontogenic neck infections[13]. As formerly discussed, antibiotic resistance is an important indicator in antibiotic selection. In a study isolating bacterial specimens from odontogenic infections, clindamycin was shown to exhibit resistance from species of Staphylococcus, Streptococcus, and Prevotella species while ampicillin was shown to exhibit resistance from Staphylococcus and Klebsiella species[14].

Limited research has been completed comparing intravenous clindamycin and ampicillin sulbactam directly in their efficacy in treating facial cellulitis of odontogenic origin. Our research study aims to further identify differences between intravenous clindamycin and intravenous ampicillin sulbactam in the treatment of facial cellulitis of odontogenic origin in pediatric patients.

PURPOSE

The purpose of this research is to quantitatively measure (via duration of hospital admission) the efficacy of intravenous clindamycin versus intravenous ampicillin sulbactam in pediatric patients with odontogenic facial cellulitis. Secondary outcomes include number of teeth extracted during cases to compare if number of extractions would be considered a significant variable in hospital admission duration. By comparing these two commonly used antibiotics, we will be able to better understand if one is more efficacious than another for treating pediatric patients within this population.

HYPOTHESIS

Null hypothesis: there is no significant difference in duration of hospital admission between pediatric patients with odontogenic facial cellulitis treated with intravenous clindamycin compared to intravenous ampicillin sulbactam.

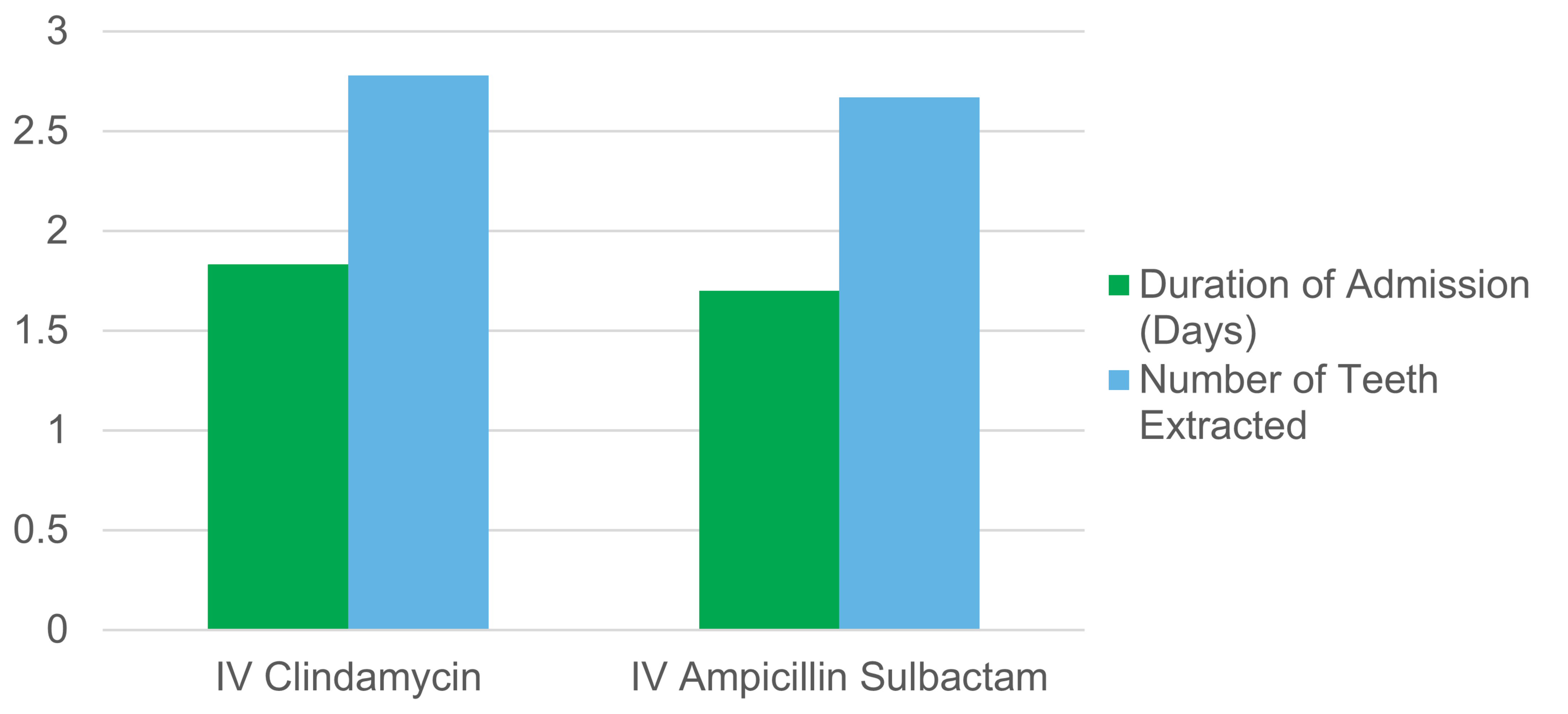
METHODS

An Epic chart review was completed from the January 1st, 2019 – December 31st, 2022 evaluating pediatric patients who were admitted and treated for odontogenic facial cellulitis. Pediatric patients were included if they were diagnosed with odontogenic facial cellulitis, if they received either intravenous clindamycin or intravenous ampicillin sulbactam, and subsequently underwent dental surgery/extractions completed by a Children's Physician Group (CPG) employed pediatric dentist at Children's Healthcare of Atlanta. Patients were excluded if they were not diagnosed with facial cellulitis of odontogenic origin, if a patient received neither intravenous clindamycin nor intravenous ampicillin sulbactam, if a patient received both clindamycin and ampicillin sulbactam throughout the course of admission, if dental surgery/extractions were not completed, and if the treating provider was not a CPG employed pediatric dentist at Children's Healthcare of Atlanta. Following data collection, a two-sample t-test and Pearson's Chi-squared test were used to measure p-value. A p-value ≤ .05 was used as the standard reference for statistical significance.

RESULTS

Initial data collection from January 1st, 2019 to December 31st, 2022 resulted in 594 patient encounters where a diagnosis of facial cellulitis of odontogenic origin was made. Following chart review, 371 patient encounters were excluded for the following reasons: patient diagnosed with non-odontogenic sources of facial cellulitis, patient not treated by CPG employed pediatric dentists (i.e. OMFS, ENT), patient had a complex medical history leading to longer admissions, patnet experienced delayed treatment times due to OR/provider availability, patient received neither intravenous clindamycin nor intravenous ampicillin sulbactam, patient received both clindamycin and ampicillin sulbactam (intravenous or oral), and/or patient did not receive any dental extractions/definitive dental treatment (i.e. discharged after antibiotics administered, receiving endodontic therapy, etc.). 223 patients who met inclusion criteria were included in the final data analysis. 157 patients received intravenous clindamycin and 66 patients received intravenous ampicillin sulbactam. For a variety of reasons, intravenous clindamycin was no longer administered near the beginning of February 2022 and therefore only intravenous ampicillin sulbactam was administered following this period. The average duration of admission of pediatric patients receiving intravenous clindamycin was 1.83 days and the average duration of admission of pediatric patients receiving intravenous ampicillin sulbactam was 1.70 days. Secondary outcome measures included number of teeth extracted during admission. The average number of teeth extracted in patients receiving intravenous clindamycin was 2.78 teeth, while the average number of teeth extracted in patients receiving intravenous ampicillin sulbactam was 2.67 teeth. Furthermore, number of teeth extracted were divided into three subgroups (1, 2, or 3+ teeth extracted during treatment); both groups had similar distribution within each subgroup. Table 1 depicts patient outcomes compared by antibiotics administered and their respective length of stay. Both primary and secondary outcome measures are represented in Graph A below. A p-value associating the length of hospital admission with antibiotics administered was calculated to be 0.164, while a p-value associating the number of extracted teeth with antibiotics administered was calculated to be 0.874. Both p-values are greater than .05, therefore no clinically significant difference can be established.

Graph A: Comparison of Duration of Admission and Extracted Teeth Between IV Clindamycin and IV Ampicillin Sulbactam Groups



STATISTICAL ANALYSIS

Table 1: Patient outcomes comparison by antibiotic administered, N=223

Outcome	Overall, N = 223[1]	Ampicillin, N = 66[1]	Clindamycin, N = 157[1]	p-value[2]
Length of Stay (Days)	1.79 (0.63)	1.70 (0.64)	1.83 (0.62)	0.164
Number of teeth extracted				0.874
1	73 (33%)	23 (35%)	50 (32%)	
2	69 (31%)	19 (29%)	50 (32%)	
3+	81 (36%)	24 (36%)	57 (36%)	

[1] Mean (SD); n (%)
[2] Welch Two Sample t-test; Pearson's Chi-squared test

CONCLUSIONS

The duration of hospital admission of patients with odontogenic facial cellulitis was similar between groups receiving intravenous clindamycin and intravenous ampicillin sulbactam (1.83 days compared to 1.70 days, respectively). The number of teeth extracted between each antibiotic group was also similar. On average, 2.78 teeth were extracted in patients receiving intravenous clindamycin and 2.67 teeth were extracted in patients receiving intravenous ampicillin sulbactam. In addition, subgroups divided into number of teeth extracted per patient (1, 2, or 3+) showed similar distributions as noted in Table 1. The p-values for both primary and secondary outcome measures were not statistically significant and illustrates no significant difference between the two antibiotics. Therefore, the null hypothesis can be accepted:

- ➢ There is no difference in duration of hospital admission between pediatric patients with odontogenic facial cellulitis treated with intravenous clindamycin compared to intravenous ampicillin sulbactam. Clinicians should still use their clinical judgement and best practices in appropriate antibiotic administration.

Our study may be limited by its sample size, and future iterations of our research project could benefit from ongoing data collection. Other metrics could also be used as a dependent variable to measure facial cellulitis and resolution of facial cellulitis following dental extraction and antibiotic administration. C-reactive protein is an inflammatory biomarker that can be used to quantitatively measure facial cellulitis. Future use of this variable would need to be further researched and hospital protocols would need to be established to record this biomarker before, during, and after dental treatment and antibiotic administration.

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