

ORIGINAL RESEARCH

Emergency dental treatment among patients waitlisted for the operating room

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(Aaron Myers)**Abstract**

This retrospective chart review examined dental emergencies among patients waitlisted for the operating room at an outpatient community dental clinic in a large academic medical center. Dental records of ASA I or II patients, who had dental restorations and/or extractions in the operating room between July 2015 to May 2019 were reviewed. Length of time the patient was waitlisted and number of emergency dental treatments (*i.e.*, therapeutic pulpotomy or a dental extraction due to acute dental pain or infection) completed in the outpatient dental clinic during the wait period were collected. Data were dichotomized as <2 and ≥ 2 emergency treatments. Kruskal-Wallis test was used to compare the groups. Of 417 charts reviewed, 294 patients met the inclusion criteria. The average time on the waitlist was 228 days. The majority of patients ($n = 222$; 75.3%) had no emergency dental treatment while waitlisted. Those who had two or more emergency treatments ($n = 34$; 11.5%) were waitlisted longer than those who had fewer than two ($n = 261$; 88.5%) ($p < 0.05$). This study highlights the importance of early intervention (*e.g.*, scheduled periodic follow-ups, interim caries arresting medication) and an ongoing discussion of possible alternatives while waitlisted. Future research identifying predictors of utilization of emergency services while waitlisted is warranted and may help identify those at increased risk of developing acute dental emergencies.

Keywords

Dental caries; Pediatric dentistry; Emergency treatment

1. Introduction

According to the Centers for Disease Control and Prevention (CDC), dental caries is the most common chronic disease in childhood in the US, affecting over half of children 6–19 years of age [1]. Untreated caries can cause pain and infection leading to problems with eating, speech, and learning, ultimately resulting in a lower quality of life [2–4]. In 2015–16, the prevalence of untreated caries in U.S. children aged 2–19 years was 13.0% and was highest for those from families living below the federal poverty level [1].

Children from low-income households and those with complex medical and dental problems often seek care at hospital and dental school-affiliated community dental clinics. Many of these patients are treated in the operating room under general anesthesia due to complexity of medical conditions, behavioral barriers such as anxiety, fearfulness and developmental delay, and extensive treatment needs. Pharmacologic management *via* general anesthesia allows for high-quality dental care while providing a non-traumatic experience for the patient. It is often the preferred choice for pre-cooperative patients, those that lack cooperative capacity to tolerate treatment in the dental chair, or the patient with acute situational anxiety after attempting non-pharmacologic management techniques and extensive

discussion with caregivers.

With general anesthesia, all treatment can be completed in a single visit in a safe and controlled environment. Due to a high volume of patients needing this treatment and limited resources, including the number of surgeons and operating room availability, wait times for treatment under general anesthesia in a hospital-setting are lengthy. A study by Lewis and Nowak in 2002 surveyed pediatric dental residency program directors regarding the wait times for dental care under sedation or general anesthesia at their training programs [5]. Twenty-six program directors across the US participated in the survey. The mean wait time reported for general anesthesia for children in pain was 28 days and was 71 days for children not experiencing pain, which program directors felt was far too lengthy. Most respondents also perceived that both the number of patients and length of time patients had to wait for care had increased over the last five years and 81% requested additional operating room time from their respective hospital facility to shorten the waiting times.

This observation that caries treatment needs in the operating room setting have increased is consistent with findings from a review of New York State ambulatory surgery facilities. The 2012 study by Nagarkar *et al.* [6] utilized data from the Statewide Planning and Research Cooperative

System (SPARCS) and found a significant increase in use of ambulatory surgery for early childhood caries between 2004–2008, from 3789 to 4828 cases. Emergency department visits also increased during the same period, possibly related to prolonged wait times for care in the operating room.

During the waiting period to receive dental treatment in the operating room, untreated caries can progress to irreversible pulpitis, initially causing pain and discomfort but can eventually lead to systemic symptoms such as facial swelling, lymphadenopathy and fever. As a result, many patients present for emergency treatment prior to their operating room appointment date and, depending on the extent of caries, a pulpotomy or extraction may be necessary to resolve the acute dental infection. However, there is a paucity of data in the literature reporting clinical outcomes of children awaiting dental treatment under general anesthesia in a hospital-setting.

The Division of Pediatric Dentistry at the College of Dental Medicine of Columbia University provides dental treatment under general anesthesia (GA) at the Children's Hospital of New York-Presbyterian, a regional referral center for tertiary care, located in the Washington Heights/Inwood neighborhoods of Northern Manhattan. It was previously found that patients who receive dental treatment under GA at the Children's Hospital of New York-Presbyterian have an average age of 5-years-old, 36.7% are Hispanic, 75.4% are on Medicaid or a Medicaid managed care, about half (49.6%) have an ASA physical status classification II, III, or IV. The most common reasons for dental treatment under general anesthesia for these children were found to be severity and extent of disease (53.2%), significant medical history (47.2%), and behavior (39.1%) [7].

Minimizing wait times for general anesthesia may help avoid the need for emergency dental treatment on pre-cooperative, anxious, and fearful pediatric patients. Analysis of emergency treatment needs for waitlisted patients is an essential in determining the need for preventive interventions, which may include more frequent follow-up visits, prevention education, topical fluoride treatment, and management products to promote caries arrest while waitlisted. The present study aimed to determine the average wait time to receive dental treatment under general anesthesia at a children's hospital at a large academic medical center and to evaluate receipt of emergency treatment during the wait period at an affiliated community dental clinic.

2. Methods

Participants included patients of the outpatient community dental clinic within the medical center who had completed dental restorations and/or dental extractions at the children's hospital operating room between July 2015 and May 2019. Only patients who were classified as ASA I (normal healthy patient) or ASA II (mild systemic disease) using the American Society of Anesthesiologists (ASA) physical status classification system were included. Patients with medical complexities requiring coordination of care with other medical services or requiring clearances for transplants were excluded, as dental treatment in the operating room was generally expedited for these patients.

Eligible patients were identified *via* retrospective chart review using electronic dental records. Data from eligible patients abstracted from dental records included: patient age, sex, date of placement on the operating room waiting list, emergency visits completed while on the waiting list, emergency dental treatments provided while on the waiting list, and date of procedure in the operating room. Emergency dental treatment was defined as having a therapeutic pulpotomy or extraction performed while waitlisted for treatment in the operating room, indicating presence of an acute dental infection. These data collected were de-identified and coded with a unique study identification number to protect confidentiality of study participants.

Several patients were found to require emergency dental treatment at the time of their first visit (*i.e.*, the date of emergency treatment was the same date as placement on the operating room waiting list). Therefore, dental emergency frequency data were analyzed both individually and as dichotomized groups (<2 and ≥2 dental emergencies). Descriptive statistics were used to describe the study sample and the Kruskal-Wallis test was used to compare the two groups with significance set at $p < 0.05$.

3. Results

A total of 417 patients were identified as having received dental treatment in the operating room between July 2015 and May 2019. Among those patients, 123 were excluded due to medical complexities requiring coordination of care with other medical services or because immediate dental clearances were needed for initiation of cancer therapy, bone marrow transplants, or organ transplants, in which cases dental treatment is necessarily significantly expedited. A total of 294 patients thus met the criteria for inclusion in the study, of which over half were male (56.1%; 129). The mean age of patients at the time of treatment in the operating room was just over five years (62 months), ranging from approximately 2–10 years of age (Table 1).

Duration on the operating room waiting list ranged from 2–1365 days, with a mean duration of 228 days and median of 190 days (Table 1). The majority of patients (75.5%; 222) did not receive emergency dental treatment while on the waiting list with the number of emergency visits ranging from 0–6 (Table 2). Only 73 patients (24.8%) presented for dental emergency treatment (pulpotomies and extractions, based on the extent of the acute dental infection) while on the operating room waiting list (Table 3). The mean duration between placement on the operating room waiting list and occurrence of the first emergency treatment was 73 days. However, 46 patients were placed on the wait list at the time of the first emergency. This was generally their first visit to the outpatient clinic and clinical evaluation identified extensive treatment needs, in addition to the immediate emergency treatment required at that visit.

Among the patients who required emergency treatments while on the waiting list, 39 received one emergency treatment and 34 required two or more emergency treatments (Table 3). A total of 28 pulpotomies and 111 extractions were completed (Fig. 1). Those patients who presented for two or more emer-

gency treatments were on the operating room waitlist for a mean of 353.1 days compared to 215.1 days for patients who presented for fewer than two emergency treatments (Chi square = 5.87, $p = 0.015$, $df = 1$).

TABLE 1. Descriptive analysis of patient's receiving treatment under general anesthesia.

Sample Characteristics (n = 295)	
Sex (n (%))	
Male	165 (56.1)
Female	129 (43.7)
Age (mon)	
Mean	62
Range	27–129
Waitlist duration (d)	
Mean	228 (SD–197)
Median	190
Range	2–1365

SD: Standard deviation.

TABLE 2. Emergency treatment frequency distribution and operating room wait time.

Emergency treatments while waitlisted	n	%	Median (d)	Minimum (d)	Maximum (d)
0	222	75.5%	175	2	743
1	39	13.3%	227	21	1107
2	18	6.1%	338.5	10	1365
3	3	1.0%	339	136	654
4	11	3.7%	246	16	582
5	1	0.3%	142		
6	1	0.3%	861		

TABLE 3. Number of emergency treatments (<2 or ≥ 2) and waitlist duration.

Emergency treatments while wait-listed	n	Mean Duration (d)	SD	Median
<2	261	215.1	169.6	185.0
≥2	34	353.1	318.3	306.5

SD: Standard deviation.

4. Discussion

Though most of the patients in the present study did not receive emergency dental treatment while on the operating room wait list, a considerable number of patients—nearly one quarter (n

= 73; 24.8%)—required one or more emergency treatments while waitlisted, suggesting the occurrence of disease progression while waitlisted. Caries development and progression is known to result from the interaction of a multitude of determinants over time, including genetic and biological factors, the social environment, the physical environment, health behaviors, and dental care. The conceptual model proposed by Fisher-Owens *et al.* [8] (2007) captures the complexity of these interactions while highlighting the overarching influence of time. Caries development and progression requires time to advance and results from a cyclical process overwhelmed by a predominance of demineralization of the tooth. Recognition of the role that time plays in this dynamic process reinforces the importance of preventing lengthy waitlist durations for treatment in the operating room, as such prolonged wait times can allow caries to progress resulting in more extensive lesions and allowing new lesions to emerge.

The mean wait time observed in this study for dental treatment under general anesthesia for pediatric patients was extensive (228 ± 197 days), thus placing children at increased risk of disease progression while awaiting treatment. It should be noted, however, that these data are inclusive of patients who experienced delayed treatment due to recurring illnesses, violation of guidelines restricting oral intake prior to anesthesia, and appointment cancellations. A common reason for procedure cancellation is recent upper respiratory infection, which can increase the chances of respiratory-related adverse events intraoperatively and postoperatively [9]. Patients have to wait 4–6 weeks after resolution of symptoms to reschedule the procedure and must present to their physician for a repeat pre-anesthesia physical examination.

Another common reason for procedure cancellation is a violation of pre-anesthesia oral intake guidelines set forth by the American Society of Anesthesiologists. Violation of guidelines is generally discovered on the day of the procedure during administration of the preoperative questionnaire and assessment. These patients must unfortunately be added to the waitlist once again and are required to wait for another operating room date to become available. Other frequently observed reasons for procedural delays are parental cancellations, failure to complete history and physical assessments on time, failure to obtain necessary medical consultations, and inability to reach parents due to incorrect/inactive telephone numbers. These occurrences lead to delays in treatment and may account for several patients in the dataset who experienced exceedingly long wait times. However, analysis of such contributors to waitlist duration as well as the specific causes of operative delays were not recorded or analyzed in the present study. Future evaluations of waitlisted pediatric dental patients should include such factors in analysis of data.

The use of completion of treatment under general anesthesia as part of the inclusion criteria creates a selection bias. Patients that were still on the wait list for treatment at the time of the study were not included in the analysis. Additionally, patients that were placed on the waitlist but then removed without completion of treatment under general anesthesia were also not included. Reasons for removal from the wait list include change in ability to tolerate treatment in the chair with different pharmacological and non-pharmacological behavior

Emergency Treatments Needs



FIGURE 1. Number of pulpotomies and extractions performed while waitlisted.

management modalities as well as receiving treatment under general anesthesia at a different facility. Waiting times and emergency treatment in these populations should be evaluated in the future.

All too often patients only present to the dentist at the onset of dental pain or signs of infection. As a result, new patients who present to the outpatient clinic for a dental emergency visit are commonly found to have extensive treatment needs, at which time a discussion with parents about various treatment options takes place. Many patients are placed on the operating room waitlist at this visit and are instructed to return for 3-month periodic evaluation visits until the scheduled treatment date.

Over half of the patients who required emergency treatment while on the wait list ($n = 46$; 63.9%), were placed on the list at the time of the first emergency visit. Because this was observed in a large portion of the study sample, and would have thus resulted in a period of zero days between placement on the waitlist and the first emergency, the data were dichotomized into patients with zero or one emergencies and those with two or more emergencies. The group with zero or one emergencies accounted for patients who were placed on the waitlist at the time of the first emergency, allowing for a true evaluation of patients whose emergencies occurred as a result of progression of caries while awaiting treatment on the operating room waitlist. This dichotomization strengthened our findings as it allowed for a more accurate representation of emergencies that occurred during the course of the patient's time on the waitlist.

A subset analysis of the 34 patients who received two or more emergency treatments revealed that their mean time on the waitlist was nearly one year (353.1 days), which was significantly longer than those who had fewer than two treatments

(215.1 days). Extractions were more commonly performed than pulpotomies in this sample, suggesting greater severity of disease progression among these patients. Facial swelling, localized abscesses and evidence of periapical pathology on primary teeth indicates need for an extraction to resolve infection. Evidently, it was this advanced stage of disease progression that prompted patients to present to the outpatient clinic for an emergency visit.

This study fills a gap in research to better understand the prevalence and types of emergencies occurring while patients with extensive dental caries are waitlisted for treatment in the operating room. The findings of this study highlight the need to slow or arrest caries progression and occurrence of acute infection among children who are waitlisted for surgical dental treatment for a prolonged period of time. The finding that children waitlisted for longer periods required greater interim emergency dental treatment highlights the importance of scheduling periodic follow-ups for patients on the operating room waitlist. These follow-up appointments should be emphasized with parents to facilitate adherence and should involve prevention education, diet counseling, topical fluoride applications, and the use of alternative management products. It also supports the potential integration, if indicated, of interim caries arresting medications, such as silver diamine fluoride, to arrest caries progression during the wait period.

An assessment by Cernigliaro *et al.* [10] (2019) suggests that parents may be amenable to this approach, applying silver diamine fluoride while awaiting operating room treatment. Despite recognized limitations, including discoloration of the tooth surface, silver diamine fluoride appears to have been well-received by parents in this study and warrants further attention for this use case scenario. Since wait-times in this sample were found to be approximately 6–8 months, an ongoing

discussion of possible alternatives to treatment under general anesthesia is recommended, especially if patient cooperation can be gained with non-pharmacologic methods. Lastly, this study also supports the need for increased hospital operating room time for the dental service, which may help reduce wait-times and alleviate the need for emergency treatments among waitlisted patients.

Future studies should include evaluation of other factors (*e.g.*, socio-environmental and behavioral) associated with receipt of emergency treatment while awaiting treatment in the operating room. Such analyses may contribute to a greater understanding of the predictors of dental emergencies in high-need patient populations to help identify those at greatest risk of requiring emergency care and to support effective preventive measures.

5. Conclusions

1. Patients in need of dental treatment under general anesthesia experience wait times of approximately 6–8 months to receive care.

2. Longer wait time may increase need for emergency treatment.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

MA, CL, RY designed the research study. MA performed the research. MA and RY analyzed the data. All authors wrote, read, and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All study procedures and waiver of written informed consent were approved for this retrospective chart review study by the Office of Human Research Protection and Institutional Review Board at Columbia University Medical Center (protocol number: AAAS3691).

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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