

The mortality of ill infants with false tooth extraction in a rural Ugandan emergency department

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Abstract

False tooth extraction (FTE), a cultural practice in East Africa used to treat fever and diarrhea in infants, has been thought to increase infant mortality. The mortality of clinically similar infants with and without false tooth extraction has not previously been examined. The objective of our retrospective cohort study was to examine the mortality, clinical presentation, and treatment of infants with and without false tooth extraction. We conducted a retrospective chart review of records of infants with diarrhea, sepsis, dehydration, and fever in a rural Ugandan emergency department. Univariate analysis was used to test statistical significance. We found the mortality of infants with false tooth extraction (FTE+) was 18% and without false tooth extraction (FTE-) was 14% ($P=0.22$). The FTE+ study group, and FTE- comparison group, had similar proportions of infants with abnormal heart rate and with hypoxia. There was a significant difference in the portion of infants that received antibiotics ($P=0.001$), and fluid bolus ($P=0.002$). Although FTE+ infants had clinically similar ED presentations to FTE- infants, the FTE+ infants were significantly more likely to receive emergency department interventions, and had a higher mortality than FTE- infants.

Introduction

False tooth extraction (FTE), also known by the terms *ebino* and infantile oral mutilation,¹ is a cultural practice found in East African countries. FTE was first reported in the medical literature in the late 1960s in Northern Uganda.² The practice spread by contact with the army through the country,³ and has in particular been embraced by families of lower income and educational status.⁴ It is a cultural belief that

the emergence of a false tooth is the cause of illness, particularly, diarrhea and fevers in infancy. Extracting this tooth is believed to be the eventual cure for the symptoms. The extraction is often performed by a village medicine man or at the local village health center.

FTE involves an incision and manipulation of the infant's gums for removal of a suspected false tooth. Sometimes this procedure is performed with crude objects such as sharpened bicycle spokes, knives, and fingernails.⁵ In the district of Rukungiri parents of the infant will often describe the use of a sharp metal hook that is typically used for basket weaving to manipulate the infant's gums. Manipulation of the gums, a highly vascular area, with such non-sterile objects provides opportunity for bacteremia and sepsis.

There have been some descriptive reports of the practice of FTE in Northern and Eastern Uganda. The morbidity and mortality of this cultural practice has not been examined in Western Uganda or in the setting of an emergency department in a rural district such as Rukungiri. Karoli Lwanga Hospital in Rukungiri is a regional medical center that serves a population of 321,000 people in Western Uganda.⁶ It is one of the only rural hospitals in Uganda to have an emergency department (ED). Almost 40% of the patients seen in the Karoli Lwanga Hospital ED are younger than 18 years of age. Among those children are infants that present in septic shock after having the cultural procedure of false tooth extraction.

The primary purpose of our retrospective cohort study is to describe infants with the diagnosis of diarrhea, or dehydration, or fever, or sepsis, or FTE that present to Karoli Lwanga ED with recent FTE, their clinical presentation, and management, and compare them to similar infants without evidence of recent FTE. The secondary purpose is to describe the prevalence of mortality of infants who have undergone FTE.

Materials and Methods

Design and study setting

A retrospective cohort study was conducted by chart review from March 2012 through April 2014 on emergency department patient records. Karoli Lwanga Hospital in the district of Rukungiri, in Southwest Uganda. The hospital is located in the outskirts of the town of Rukungiri and serves a district that spans 1445 square kilometers. As of 2012 it had a population of 321,300 classifying it as a rural area.⁶ The

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hospital is equipped and staffed to provide emergent as well as basic medical and surgical services.

Study groups and data collection

The emergency department maintains an electronic database of scanned charts. This database was queried with a key word search for all infants twelve months and younger with a primary or secondary diagnosis of false tooth extraction, sepsis, diarrhea, dehydration, or fever. These charts were then reviewed by the primary author for a diagnosis of FTE, recent false tooth extraction in the HPI, or physical examination of the oral cavity significant for manipulation to the dental ridge. These FTE+ records comprised the study group, and remainder of records, infants with sepsis, diarrhea, dehydration, or fever but without chart evidence of FTE (FTE-), comprised the control group.

From each chart we extracted demographic information including age, and gender, and clinical information including initial vital signs, symptoms, timing of symptoms till treatments, treatment, and status. In this ED, it is routine for all patients to receive follow up, consisting of telephone contact for infants discharged from the hospital, or in-person contact for those who remained hospitalized. The records from FTE+ and FTE- subjects were also reviewed by the primary investigator for other clinical information including, review of symptoms, relative timing of FTE if it had occurred, and emergency department management. Patient identifiers were kept in password protected files and encrypted devices. We compared the study and control groups in regards to demographic information, clinical presentation, management and mortality. The mortality rate of all infants 12 months of age or younger presenting to this ED during the time period was also calculated. Standard normal vital signs for age were used to define tachycardia or bradycardia, hypoxia, and hypothermia.⁷

IRB approval was obtained from Mbarara University of Science and Technology and the Ugandan National Council for Science and Technology.

Analysis

Univariate statistics were used to describe the FTE+ and FTE- group for each of the variables including age, hypoxia, and abnormal heart rate, and if treatment was given such as antibiotics or fluids. The relative risk was then calculated using a standard on-line Fisher exact calculator to determine significance.

Results

During the study period, 833 children 12 months and younger were seen in the ED. Of those, 91 patients had a documented final diagnosis of diarrhea, dehydration, fever, sepsis or false tooth extraction. Of these 91 subjects, 28 also had documented FTE (Figure 1). The mean age at which FTE was performed was 4.2 months, with a range of 4 days to 10 months. There were an equal number male and female infants who had FTE performed.

The overall mortality rate of infants 12 months and younger seen in the ED during this time period was 5.7%. The mortality rate of FTE+ infants was 5/28 (17.8%) and FTE- group was 9/63 (14%) (P=0.22). The mortality of infants with diarrhea in FTE+ subjects was 2/18 (11.1%) and in FTE- subjects was 3/45 (6.7%) (P=0.31). The

clinical presentation of study subjects is summarized in Table 1.

Information of the timing of FTE relative to the ED visit was available on 14 of 28 records. All 14 infants had symptoms prior to the FTE procedure. All false tooth extractions were performed within seven days of presenting to the ED. False tooth extraction was performed a mean of 2.1 days after onset of initial symptoms and a mean of three days before presentation to the ED. Subjects with FTE presented to the ED a mean of 3.64 days and subjects without FTE 3.46 days, after symptoms began. Univariate analysis of the clinical presentation did not differ significantly between the two groups when comparing heart rate and oxygen saturation (P=0.19 and P=0.18 respectively). The FTE+ group in general were younger. A significantly greater portion of the FTE+ group received emergency department treatments including intra-

venous fluids (P<0.001) and antibiotics (P=0.022; Table 1).

All five of the expired FTE+ infants expired during their hospital stay and all of these infants were under the age of 6 months. FTE negative infants who expired ranged in age from 1 day to 9 month of age. All four deceased FTE+ infants with recorded pulse oximetry readings had oxygen saturations less than 90% on presentation to the ED. None of these infants had tachycardia at presentation. Four infants received fluid resuscitation in the ED.

Discussion

Data for the mortality of children with FTE is variable. The reported incidence of mortality in children with false tooth extraction ranges widely from 10-85%.⁸⁻¹⁰ Our

Table 1. Overview of Infants with and without false teeth extraction (FTE).

Demographics/symptoms/treatment	FTE+ n=28	FTE- n=63	P value *
Age 0-3 months	12	17	
Age 4-7 months	15	18	<0.0001
Age 8-12 months	1	28	<0.0001
Female	14	31	1
Male	14	32	1
Ave days of symptoms at presentation to ED	3.6	3.4	0.53°
Ave days of symptoms at FTE performed	2.1	NA	
Fever in ED or with current illness	13	24	0.50
Diarrhea	18	45	0.62
Abnormal heart rate	8	17	0.19
Hypoxia	11	18 of 57	0.18
Fluid resuscitation in ED	19	28	0.02
Antibiotics in ED	26	34	0.0001
Expired	5	9	0.217

*Fisher's exact; °Student t-test.

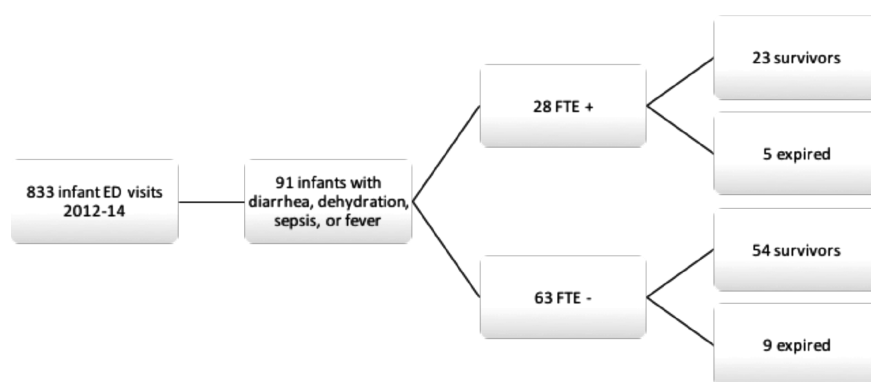


Figure 1. Flow diagram of patient outcomes with and without false tooth extraction.

data falls within this range. Infants within the inclusion diagnoses had a higher mortality than all infants who present to Nyakibale ED. In our two-year study sample, mortality tended to be even higher in subjects who had received recent false tooth extraction.

Increased mortality from FTE has been suggested to be due to inoculation of blood with oral bacteria leading to a bacteremia and sepsis.^{4,9,11} A study in S. Africa found bacteremia in 30% of individuals who presented to a dental clinic for tooth extraction.¹² In addition to bacteremia, diarrhea alone with false tooth extraction may play a role. In our study, there was a trend toward a larger difference in mortality between the FTE+ and FTE- infants who had diarrhea than the difference in mortality between the study and control groups, suggesting the need to also consider the role of associated effects of enteritis such as dehydration leading to hypovolemia in these deaths.

Many parents and extended caregivers believe that high fevers and diarrhea play a role in the emergence of the *false tooth*.^{4,5,8} Coincidental timing of these events might influence this thinking. A Northern hospital in Uganda found that the most common age for FTE was 5 months which is similar to the average age of FTE in our study.¹¹ This is also the age infants commonly experience gingival swelling from the eruption of their first baby tooth, or have their first bouts of diarrhea from infectious enteritis. Many mothers attributed diarrhea to teething and had little understanding of infection as an etiology for diarrhea.⁸ In the Ugandan district of Bushenyi, 67% of surveyed families who had a child with FTE performed believed the cause of the false tooth was prolonged, excessive diarrhea.⁴ Often, the illness was treated by traditional medicine alone. Seventy percent of families surveyed used traditional medicine (FTE) alone to treat the diarrhea presumed to be causing *false teeth*, and only 21% stated that they had used both traditional and modern medicine to treat false teeth.⁴

In our study of patients that presented to the ED, 28% of infants with diarrhea had received both, traditional medicine and modern medicine. Although delay in seeking *modern* medical treatment may worsen dehydration, there was little difference in the average time of onset of symptoms to presentation in the ED between FTE+ and FTE- subjects, 3.6 and 3.4 days respectively. Prior investigation shows that most women were not able to recognize signs of dehydration or relate proper treatment of dehydration from diarrhea, but many practiced the removal of teeth buds as a treatment for diarrhea.⁴ Amongst study subjects

with diarrhea, those with FTE had a mortality of 11.1% compared to those with no FTE (6.67%; $P=0.31$). The mortality of infants with diarrhea and FTE may have trended higher for a number of reasons. The subjects may have been unable to rehydrate following FTE due to oral pain from the procedure. One may hypothesize that the infants with diarrhea may be presenting with worse dehydration than infants who did not have FTE. In our sample, there was not a significant difference in heart rate, a marker for dehydration, between the FTE+ and FTE- infants. In our study, a significantly greater proportion of infants with FTE were treated with IV fluid boluses and antibiotics. The multicenter study by Maitland *et al.* on fluid resuscitation uncovered interesting results.¹³ They found that severely ill children in resource limited settings of East Africa had a higher mortality rate when treated with 20 mL to 40 mL of fluid bolus than those not given fluid boluses. Maitland's study, however, excluded subjects with gastroenteritis.¹³ A close examination of the records of our FTE+ infants that expired shows that none of these infants had tachycardia at presentation in the ED. A sensitive marker of sepsis and dehydration is tachycardia. It is possible that these infants were already severely ill and in the final stages of organ shut down so no longer able to mount a compensatory response, similar to the late phase of sepsis children in Maitland's study. Furthermore, all of our FTE+ subjects that expired were hypoxic at time of presentation in the ED. Hypoxia in those infants that expired with no respiratory symptoms further suggests that the patient's perfusion was severely diminished at time of presentation. Hypoxia in the absence of respiratory symptoms was a marker of a late stage of illness and poor outcome in these severely ill infants.

Our study has several limitations. This was a retrospective study design. Data was not prospectively collected in a uniform manner. Not all data was available in all records. As mentioned above, it is likely that many more infants have this procedure performed than see medical attention. The ED providers do not routinely ask if FTE was performed on all infants and it may not have been evident on exam. Even with oral findings consistent with the procedure, parents often deny the procedure was done out of fear of upsetting the health care provider. Many families prefer traditional care to *modern* medical care, and might not share this type of information readily. Similarly, follow up information after infants had left the hospital relied on the honesty and knowledge of the caregiver offering the information.

Conclusions

Infants presenting to Karoli Lwanga Emergency Department with false tooth extraction, had a modest increase in mortality rate, though not statistically significant ($P=0.22$), despite more aggressive management of illness than was administered to similar FTE- patients in this setting. While our two-year sample size was too small to achieve statistical significance, it is possible that in a larger samples size, FTE would be associated with significantly higher mortality. FTE in our sample was a marker for sicker infants that received greater resuscitation efforts. Our data serve as impetus for a larger prospective investigation of the morbidity and mortality in young infants, and for the development of educational strategies to prevent mortality associated with this procedure in infants.

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