Comparison of palatal and alveolar cysts of the newborn in premature and full term infants

Cara L. Donley, DMD Linda P. Nelson, DMD, MScD

Dr. Donley is an intern at Children's Hospital in Boston, MA; Dr. Nelson is an associate attending at Children's Hospital in Boston, MA and the assistant clinical professor at Harvard School of Dental Medicine. Correspond with Dr. Donley at donley@al.tch.harvard.edu

Abstract

Purpose: *The frequency of cysts has been reported to be high in newborns, but they are rarely seen after three months of age. There has been a lack of studies describing the clinical prevalence in the premature infant after 22 weeks and less than 37 weeks gestation. The purpose of this study was to quantify and describe the clinical prevalence of palatal and alveolar cysts in premature infants as compared to full term infants.*

Methods: *Sixty premature infants, born at less than 37 weeks gestation, and 60 term infants, born greater than 37 weeks gestation, were examined in the first few days after birth for the presence of palatal and alveolar cysts. Alveolar cysts were further classified according to location as either maxillary or mandibular, and anterior or posterior. Information regarding birth weight, race, sex, and maternal health during pregnancy was also collected.*

Results: *The prevalence of palatal cysts in the premature infant (9%) is less than the prevalence in term infants (30%), to a statistically significant level (P<0.004, by the Fisher's exact test). Differences between preterm and term infants were also noted in the prevalence of maxillary anterior alveolar cysts, (preterm having 27% and term 58%, P<0.0005) and maxillary posterior alveolar cysts (preterm 2% and term 10%, P<0.06). The prevalence of palatal and maxillary alveolar cysts was demonstrated to increase with increasing gestational age, increasing postnatal age, and increasing birth weight (by plots of cumulative percent). No significant differences were found for gender or for race.*

Conclusion: *The prevalence of palatal and alveolar cysts in the premature infant is less than the prevalence in the full term infant to a statistically significant level. Palatal and maxillary alveolar cysts increase with increasing gestational age, post-natal age, and birth weight. (Pediatr Dent 22:321-324, 2000)*

Fromm's 1967 study[1] of 1,367 newborns differentiated three types of oral cysts: Epstein's pearls, Bohn's nodules, and dental lamina cysts. Epstein's pearls, first described in 1880, are remnants of epithelial tissue trapped during the palatal fusion that occurs during the 8th-10th gestational week.[1,2] Bohn's nodules were originally described in 1866 as remnants of mucous gland tissue found on the buccal or lingual aspects of the dental ridges. Dental lamina cysts (also called glands of Serres in 1817) were postulated to be found along the crest of the ridges.[1,4,8] These terms, however, are frequently confused and used synonymously. In addition, despite Fromm's [1] suggestion, mucous glands are rare on the lateral surfaces of the alveolar ridges. Currently, the terms palatal cysts (designating epithelial cells that persist at the site of fusion of the palatal shelves) and alveolar cysts (remnants of degenerating dental lamina on the buccal, lingual, or crest portion of the alveolar ridge), are used in descriptions to avoid confusion.[4] Alveolar cysts have also been referred to as "gingival cysts" or "inclusion cysts" in some texts. The clinical description of palatal and alveolar cysts varies in color from white, to gray, to yellow nodules, in size from a pinhead to 3 mm, and in numbers from one to six.

The frequency of inclusion cysts is high in newborns, but they are rarely seen after 3 months of age.[5] However, no published study has investigated the prevalence of palatal and alveolar cysts in the premature newborn, or infant born under 37 weeks gestation. As indicated in Table-1, reported prevalence in the literature for term infants varies from 65-85% for palatal cysts and depending on location, 9% for mandibular alveolar cysts to 36% for maxillary alveolar cysts. Several of the studies indicate a difference in prevalence exists between whites and blacks, with whites more likely to have palatal and alveolar cysts. A gender difference has not been reported. [1,4,7]

Several histology studies of alveolar and palatal cysts have been done in fetuses up to 22 weeks gestational age. Cystic formation has been noted in the midline of hard palates 3.5-6 months gestational age.[9] For alveolar cysts, it is during the morphodifferentiation (late bell stage) of tooth development that a portion of the dental lamina fragments into numerous islands of odontogenic epithelium.[9,10] Cystic changes have been observed in some of these epithelial islands. These epithelial remnants of dental lamina have the capacity as early as 10 weeks *in utero* to proliferate, keratinize, and form small alveolar cysts. Moskow and Bloom[10] reported that dental lamina-derived microkeratocysts (alveolar cysts) develop and increase in number from the 12th to the 22nd gestational week with a maximum of 190 cysts per fetus. Mid palatal microkeratocysts reach a peak number of below 20 at week 14 and do not supposedly become more numerous with time.

Evidence exists of fetal cyst development through differentiation phenomena and suggests a discharge mechanism is responsible for cyst disappearance.[3] The reduction in number from the fetal period to the postnatal period of both alveolar and palatal cysts is thought to be due to the cyst wall fusing with the oral epithelium and discharging the cystic keratin. [9]

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Table 1. Studies of Inclusion Cysts and Reported Prevalence

Author	*Group*	*N*	*Palatal*	*Alveolar*	*Combined*
Fromm (1967)	1-2 day old full term newborns	1,367	----------	----------	75.8 %
Cataldo and Berkman (1968)	1-5 day old full term newborns	209	65%	Max-36% Mand 9.9%	80%
Friend (1990)	full term newborns	500	White-75% Black-55%	25%	----------
Monteleone and McLellan (1964)	1 day old full term newborns	393	White- 85% Black-79%	---------	----------
Jorgenson (1982)	Full term newborns	2,258	64.3%	Whites- 53% Blacks- 40%	----------
Moreillon and Schroeder (1982)	Fetal heads 8-22 weeks gestation	55	Less than 20 per fetus	190 per fetus maximum	----------

Part of the cysts can persist and are observed in the subepithelial connective tissue or within the large rete ridges of the oral epithelium.[3,11,12] These rarely become activated.

This clinical study investigated the prevalence of palatal and alveolar cysts in premature and full term infants, including studying gender and racial differences.

Materials and methods

Sixty premature infants, less than 37 weeks gestation, and 60 full term infants, greater than 37 weeks gestation, were examined in the Neonatal Intensive Care Unit and full term nursery of Beth Israel Deaconess Medical Center during a two year period. Beth Israel Deaconess is a Level III newborn care facility in Boston, MA. Children were randomly selected and permission was obtained from the unit attending neonatologist and nurses for each child prior to approaching the parents or guardians for consent. All children in the NICU and full term nursery present during exam days were eligible for the study. Children were excluded from the study only if their condition was determined by the attending to be too unstable for the oral manipulation of the exam. Informed parental consent was obtained prior to the oral exam.

Cysts of the newborn were defined as freely mobile, circumscribed, nodular lesions classified according to location in the oral cavity as either palatal or alveolar. Alveolar cysts were further classified by location into either the maxilla or mandible and anterior (canine and incisor position) or posterior. Information regarding date of birth, gestational age, race, sex, birth weight, and maternal health during pregnancy was collected for each infant and analyzed. For the infants who were intubated, exams were done at extubation. For the first 50 premature newborns, the same two examiners conducted the exams concurrently to create inter-examiner reliability. Exams were done using portable lights and all oral findings were recorded onto data sheets.

Results

One hundred twenty newborns from both the NICU and the full term nursery of Beth Israel Deaconess Medical Center were examined during a two-year period. Sixty-one (51%) of the infants examined were female and 59 (49%) were male. Eighty-five (71%) were Caucasian and 35 (29%) were non-Caucasian. The preterm infants ranged in gestational age from 24 weeks to 37 weeks and term infants ranged in gestational age from 37 weeks to 42 weeks. Oral examinations were performed in a postnatal age range of 30 weeks to 39 weeks for preterm infants and 37 to 42 weeks for term infants. While term infants were examined within an average of 1 day after birth, the preterm infants were examined an average of 12 days after birth. Birth weight ranged for preterm newborns from 620 grams to 3365 grams and term infants from 1965 grams to 4460 grams with the median preterm birth weight being 1740 grams and median term weight being 3238 grams (Table-2).

Table 2. Preterm and Term Data Summary

Collected Data	*Preterm*	*Term*	*P values*
Birth Weight (median)	1740 g	3238 g	<0.0005
Gestational Age (median)	32.4 weeks	39.1 weeks	<0.0005
Postnatal Age (median)	34.9 weeks	39.3 weeks	<0.0005
Interval from birth to exam	12 days	1 day	<0.02
% male	52	50	<.050
% Caucasian	72	70	<0.50
Maternal Age (median)	32	32	<0.85

P values determined by Fisher's exact test.

Table 3. Oral Finding Percentages between Preterm and Term Infants

Cyst Location	*Preterm (%)*	*Term (%)*	*P value*
Palatal	9	30	<0.004
Maxillary Anterior	27	58	<0.0005
Maxillary Posterior	2	10	<0.06
Mandibular Anterior	13	10	<0.39
Mandibular Posterior	3	2	<0.50
	N	60	60

P values determined by Fisher's exact test.

Five (9%) of the preterm infants had palatal cysts at examination while 17 (30%) of the term infants had palatal cysts, a statistically significant difference using a Fisher's exact test with a $P < 0.004$ (Table-3). Statistically significant differences using Fisher's exact tests and one-sided Fisher's exact tests between preterm and term infants were noted as well in prevalence of maxillary anterior ($P<0.0005$) and maxillary posterior ($P<0.06$) alveolar cysts. Analysis using linear regression revealed that as gestational age increased per week, there was a 1.2 times more likely chance of seeing an oral cyst (either palatal or alveolar). Palatal cysts were 6.6 times more likely to be seen in term infants than in preterm infants. Additionally, maxillary anterior cysts were 2 times more likely to be seen in preterm infants, but 5.5 times more likely to be seen in term infants. Plots of cumulative percent vs. gestational age, postnatal age, and birth weight, all indicate the prevalence of palatal and maxillary anterior and maxillary posterior alveolar cysts increase with increasing gestational age, postnatal age, and birth. No statistically significant differences were found in cyst prevalence in preterm and term groups when groups were divided by sex or race.

Discussion

This study of 120 newborns found the prevalence of palatal and alveolar cysts in the premature infant population to be significantly less than the prevalence in the full term infant population. Fetal studies have demonstrated an increase in dental lamina derived and mid-palatal cysts in the developing oral mucosa with estimates as high as 190 alveolar cysts and 20 palatal cysts per fetus. Knowing that approximately 75-80% of term newborns have 1-6 palatal and or alveolar cysts, it was expected that an inverse relationship would exist between the cyst prevalence and gestational age, postnatal age, and birth weight, thereby predicting more preterm infants than term infants would have cysts.

This study, however, found the converse to be true for palatal and maxillary alveolar cysts to a statistically significant level. While the number of infants with mandibular alveolar cysts was too small to make any definitive conclusions, mandibular oral epithelial development is likely to mimic that of the maxilla. Mandibular ridge visibility was not as easy to access during the exams since premature infants often experienced oxygen desaturation with tongue manipulation. Mandibular cysts, therefore, were likely to have been present, but missed by the oral exam. Therefore, a direct relationship predicts that with increasing gestational age, increasing postnatal age, and increasing birth weight, the prevalence of cysts (palatal, alveolar, or both) increases. Gestational age, postnatal age, and birth weight are all co-dependent factors. As gestational age increases, by definition, postnatal age (postnatal age = gestational age + days to exam), increases and with increasing gestational age, birth weight increases linearly. The finding of more cysts with increasing birth weight disagrees with Fromm's conclusion that no correlation existed between the size of the infant and the prevalence of oral cysts. A majority of the cysts, when seen, occurred after 38 weeks gestation, after a "critical" birth weight was achieved, and after a 39 week postnatal age.

The fetal studies of the lateral and frontal sections of fetal heads, tabulated cysts that were clinically unerupted or submucosal. The estimates of 190 alveolar and 20 palatal cysts were all of clinically nonvisible, submucosal, findings. Cyst development, or the epithelial degeneration, may occur beneath the oral mucosa, with only a small number having their walls fuse with the oral epithelium for the discharge of cystic keratin, a point at which the cyst is clinically visible in the oral cavity. A premature infant may have a higher prevalence of cysts submucosally than a term infant, but less prevalence clinically. A critical factor related to the gestational age or the birth weight, may affect oral development such that clinically, after some threshold is achieved, more of the cysts that were hypothetically present *in utero* are discharged to the surface, visible on the oral epithelium as palatal or alveolar cysts.

This study examined prevalence, a phenomena that occurs at a point in time. With the eventual fusion with the oral epithelium, the cysts discharge the keratin and the free floating degenerated epithelial cells, effectively "disappearing." Previous studies examined the term infants 1 to a maximum 5 days post-birth. While the exams of the term infants similarly occurred on average 1 day post-birth, the exams of the premature infants occurred on average almost 12 days post-birth. The ability to examine the premature infants at an earlier point in time post-birth was limited by the critical health condition of the infants in the Level III NICU. However, the possibility remains that an unknown factor associated with the birth process itself affects oral epithelial development. Although cysts of the newborn reportedly take several weeks to disappear and the 12 days on average it took to examine the preterm infant was not an extremely long period of time, cysts present those first few days of life may have disappeared prior to the oral examination. Additionally, intubation, with the constant pressure of the tube on the maxilla and palate, could have altered the clinical picture in critically ill preterm newborns.

In this study, gender differences were not demonstrated, similar to previous reports for term infants. Racial differences were not demonstrated, in contrast to previous studies that found Caucasians more likely to have cysts than Blacks. This study included nine Black infants. Seventy percent of this study's preterm infants and 72% of the full term infants were Caucasian while the non-Caucasian group consisted not only of blacks, but also of Asians, Latinos, and Indians.

Conclusions

In this examination of 120 infants in the Neonatal Intensive Care Unit and full term nursery, it was determined that:

1. The prevalence of palatal and alveolar cysts in the premature infant was less than the prevalence of term infants to a statistically significant level.
2. The prevalence of palatal and alveolar cysts was demonstrated to rise with increasing gestational age, increasing postnatal age, and increasing birth weight.
3. No significant differences were found in the prevalence of palatal and alveolar cysts for gender or for race.

Dental literature contains few investigations on the oral findings in premature infants, a group comprising 11% of all births. In the future, a larger pool of infants that is racially diverse would be needed to confirm some of the conclusions of this study. Histological and molecular studies are needed to elucidate the signaling patterns for oral development and tooth eruption. Factors associated with prematurity may disrupt the pattern and timing of oral development, as evidenced by less prevalence of palatal and alveolar cysts in this group.

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Abstract of the Scientific Literature

Recurrent Aphthous Stomatitis

Recurrent aphthous stomatitis (RAS) is recognized as the most common oral mucosal disease in men and women of all ages, races, and geographic regions. Based on epidemiologic studies, the prevalence of RAS is between five and 25% in the general population; peak age of onset for RAS is between 10 and 19 years. The lesions are separated into three classic forms: minor, major, and herpetiform. Minor RAS is characterized by recurrent, round, small (<10 mm) painful ulcers with shallow necrotic centers, raised margins, and erythematous halos. In contrast, major RAS lesions are large (>10 mm in diameter), deep, and very painful. Scarring is associated with major RAS lesions and these lesions may persist for weeks to months. Major RAS lesions occur most frequently on the lips, tongue, soft palate, and palatal fauces. The least common form of this disease, herpetiform aphthous ulcers, is characterized by multiple small clusters of pinpoint ulcers. These ulcers occur throughout the oral cavity and last from 7 to 30 days. Several systemic disorders including systemic lupus erythematosus, ulcerative colitis, Crohn's disease, Behçet's disease, Reiter's syndrome, and acquired immunodeficiency syndrome, present with oral ulcers that are similar to those associated with RAS. Topical anti-inflammatory agents, various analgesic preparations as well as systemic glucocorticoids are used to treat RAS. The primary treatment of RAS lesions utilizes topical anti-inflammatory agents.

Comment: In spite of the prevalence of recurrent aphthous stomatitis and research into its causes, no principal etiology has been identified. Current therapies focus on promoting ulcer healing, reducing ulcer duration, and preventing recurrence or reducing the frequency of occurrence. **PS**

Address correspondence to: Dr. Jonathan A. Ship, Professor and Vice Chair, Department of Oral medicine, pathology, Oncology, University of Michigan, School of Dentistry, Ann Arbor, Michigan 48109-1078 E-mail: HREF="mailto:jship@umich.edu"

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