Nonsynostotic Occipital Plagiocephaly: Factors Impacting Onset, Treatment, and Outcomes

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Background: Nonsynostotic occipital plagiocephaly remains a diagnosis of concern in infancy. This study evaluates factors affecting the onset, treatment, and outcomes of nonsynostotic occipital plagiocephaly.

Methods: A retrospective chart review and telephone survey were performed. A posterior occipital deformation severity score was used. Factors such as demographics, behavioral and helmet therapy, feeding patterns, torticollis, multiple gestation pregnancies, prematurity, and congenital nonsynostotic occipital plagiocephaly were evaluated.

Results: One hundred five infants were identified. Of these, 95 percent were Caucasian, 93 percent were from two-parent households, and 70 percent were from households earning more than $50,000. Repositioning was attempted in 95 percent, and 45 percent progressed to helmet therapy. When comparing change in posterior occipital deformation severity score with helmet therapy to repositioning, a difference was found ($p < 0.05$). Forty-nine percent of patients were breast-fed, and when compared with the general population, a difference was found ($p < 0.05$). Twenty percent of infants had torticollis, and when compared with population norms, a difference was found ($p < 0.05$). Twelve percent of patients were twins, and when compared with population norms, more twinning occurred ($p < 0.05$). Congenital nonsynostotic occipital plagiocephaly was found in 10 percent of patients and did not result in an increased risk of progression to helmet therapy.

Conclusions: This study demonstrates trends that may predict additional risks for developing nonsynostotic occipital plagiocephaly, including torticollis, plural births, and increased socioeconomic affluence. In addition, the nonsynostotic occipital plagiocephaly cohort was breast-fed less than the general population, demonstrating that breast-feeding may be preventative, as breast-fed infants are repositioned more frequently and sleep for shorter periods. As in other studies, cranial molding helmet therapy was more effective in correcting nonsynostotic occipital plagiocephaly than repositioning alone. (*Plast. Reconstr. Surg.* 119: 1866, 2007.)

Since the implementation of the Back-to-Sleep initiative, the incidence of developing a "position of comfort" in sleep that leads to deformational plagiocephaly, or skull molding, has risen dramatically. Deformational plagiocephaly, more specifically called nonsynostotic occipital plagiocephaly, now affects one in seven children.[1] Although many infants suffer from some degree of nonsynostotic occipital plagiocephaly when they begin to roll independently, the majority self-correct their deformity. However, some infants develop a persistent sleep position and position of comfort that results in significant nonsynostotic occipital plagiocephaly that is not corrected. Unless intervention is initiated, persistent craniofacial deformities can persist and cause significant distress for the family. We now fully appreciate the clinical and radiographic diagnosis of nonsynostotic occipital plagiocephaly[2,3] that differentiates it from the rare entity of synostotic posterior plagiocephaly, or lambdoid craniosynostosis. As a result of the

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significant increase in referrals to craniofacial centers for nonsynostotic occipital plagiocephaly, there has been a growing interest in the cause, risk factors, diagnosis, and treatment of this epidemic. To date, there has been little work investigating such issues as the impact of breast-feeding and its effects on sleep patterns on the development of nonsynostotic occipital plagiocephaly. The purpose of this case-control study was to evaluate various factors impacting the onset, treatment, and outcomes of nonsynostotic occipital plagiocephaly, including the household demographics, behavioral modification therapy with repositioning in sleep, cranial molding helmet therapy, infant feeding patterns with specific emphasis on breast-feeding, multiple gestation pregnancies, prematurity, torticollis, and congenital plagiocephaly.

PATIENTS AND METHODS

A retrospective medical chart review of 133 patients diagnosed with nonsynostotic occipital plagiocephaly and treated at the Cleft-Craniofacial Center from January of 2001 through January of 2003 was performed. Of the 133 nonsynostotic occipital plagiocephaly cases reviewed, 128 met the inclusion criteria, which included a diagnosis of nonsynostotic occipital plagiocephaly with adequate follow-up. Of those 128 potential participants, a total of 105 families consented to participate in a telephone interview. A standardized questionnaire was used during the telephone interview to obtain information and confirm data obtained from the chart review regarding family demographics, sleep patterns, behavioral modification therapy including repositioning, cranial molding helmet therapy, feeding patterns with specific emphasis on breast-feeding, torticollis, multiple gestation pregnancies, prematurity, and congenital nonsynostotic occipital plagiocephaly. The severity of nonsynostotic occipital plagiocephaly, on initial presentation and at final follow-up or completion of treatment, was scored subjectively by a single craniofacial surgeon using a posterior occipital deformity severity score ranging from 1 to 9, where 1 represents no identifiable deformity and 9 represents the most severe imagined deformity (Table 1). Data from our cohort of nonsynostotic occipital plagiocephaly patients were then compared with national statistics regarding breast-feeding, torticollis, multiple gestation pregnancies, and prematurity. Data were analyzed using a chi-square analysis and an unpaired *t* test where applicable. Differences were considered significant if $p < 0.05$.

Table 1. Posterior Occipital Deformation Score

Mild	1
	2
	3
Moderate	4
	5
	6
Severe	7
	8
	9

RESULTS

Demographics

Of the 105 patients, 70 percent were male (74 of 105) patients and 30 percent were female (31 of 105) patients. Fifty-seven percent of patients had right-sided nonsynostotic occipital plagiocephaly, 24 percent had left-sided nonsynostotic occipital plagiocephaly, and 18 percent had bilateral nonsynostotic occipital plagiocephaly. Our patient population included 95 percent Caucasians (100 of 105), 2 percent Hispanics (two of 105), 2 percent African Americans (two of 105), and 1 percent of Middle Eastern descent (one of 105). The average gestational age at birth was 38.4 weeks (range, 25 to 42 weeks); 62 percent were born by means of normal spontaneous vaginal delivery (65 of 105), 25 percent were born by cesarian section (27 of 105), and 12 percent received vacuum and/or forceps assistance (13 of 105). The mean birth weight was 6 lb 15 oz (range, 1 lb 8 oz to 9 lb 15 oz.). General information regarding the primary caregiver of the patient, and the family unit, was obtained. The average age of the primary caregiver at the birth of the child patient was 31.7 years (range, 18 to 42 years), and the average number of children of the primary caregiver was 1.96 (range, 1 to 6). The formal education of primary caregivers were found to be 1 percent with no high school (one of 105), 14 percent with high school (15 of 105), 62 percent with undergraduate college education (65 of 105), and 23 percent with graduate school education (24 of 105). The family unit household structure included 3 percent single-mother families (four of 105), 93 percent two-parent homes (98 of 105), and 3 percent of family units including two parents and at least one grandparent living at home (three of 105). The average household annual income included 3 percent of families earning less than $20,000 (four of 105), 19 percent of families earning between $20,000 and $50,000 (20 of 105), 52 percent of families earning between $50,000 and $100,000 (55 of 105), and 18 percent of families with an annual income of greater than $100,000 (19 of 105). Seven families refused to answer the question regarding annual household income. The average age of the patient at presentation to the craniofacial center was 6.5 months (range, 1 to 18 months). At the time of initial presentation, the average posterior occipital deformation severity score was 5.7 (range, 2 to 9).

Treatment: Behavioral Modification/Helmet Therapy

Therapeutic intervention for children diagnosed with nonsynostotic occipital plagiocephaly included both behavioral modifications with repositioning and helmet therapy. Behavior modification consisted of attempts at repositioning during sleep, change in position during feeding, rearrangement of stimulating objects and cribs, and so forth. Success with conservative treatment was measured by the ability to change the infant's sleep position resulting in a correction of deformational plagiocephaly. Ninety-five percent of children diagnosed with nonsynostotic occipital plagiocephaly (100 of 105) received behavioral modification, including attempts at repositioning, as the initial method of treatment. Of those children repositioned, nonsynostotic occipital plagiocephaly was not corrected in 30 percent, partially corrected in 23 percent, and successfully corrected in 38 percent. The average change in posterior occipital deformation severity score with repositioning was 1.31 (range, –2 to 5, where negative values indicate worsening of the occipital deformity). Forty-five percent of patients who attempted behavioral modification therapy including repositioning as the initial treatment ultimately progressed to cranial molding helmet therapy. The average age of initiation of cranial molding helmet therapy was 7.6 months (range, 3 to 14 months), and the age at helmet therapy termination was 11.3 months (range, 8 to 20 months). This resulted in an average length of helmet therapy of 3.7 months (range, 8 to 20 months). The average change in posterior occipital deformation severity score with cranial molding helmet therapy was 3.11 (range, 1 to 6). When comparing the means of change in posterior occipital deformation severity score for repositioning versus cranial molding helmet therapy, using a Mann-Whitney *U* test, there was a significant difference ($U = 356.5$, $p < 0.05$), demonstrating a greater improvement with helmet therapy. These data demonstrate that a significantly greater change in posterior occipital deformation severity score was achieved with cranial molding helmet therapy when compared with conservative therapy with repositioning.

An analysis was performed regarding the age of presentation to the craniofacial surgeon and initiation of treatment compared with the likelihood of success with therapy. For this analysis, the cohort was divided into three groups: those who failed conservative therapy with repositioning and progressed to helmet therapy, those who were partially successful, and those who were successful with repositioning and did not progress to cranial molding helmet therapy. Using a chi-square analysis and comparing the three groups with regard to success of conservative therapy with repositioning, no significant difference was found (chi-square = 4.00; $df = 2$; $p > 0.05$). These data demonstrate that there is no significant difference between the three groups with respect to conservative therapy. Using a one-way analysis of variance to compare the age of presentation and initiation of therapy to the three groups, no significant difference was found ($f = 0.20$; $p > 0.05$). These data indicate that treatment success was not influenced by the age of presentation and initiation of therapy.

Breast-Feeding

The specifics of breast-feeding were elicited from mothers to determine whether the standard alternating left–right cradle position was used during the feed. This was important because infants with nonsynostotic occipital plagiocephaly and associated torticollis occasionally refuse to turn their heads to feed from each breast in the standard cradle position. This then leads to mothers breastfeeding using the "football cradle position," where the infant is tucked beneath the mother's axillae. For example, a child with right-sided nonsynostotic occipital plagiocephaly and left-sided torticollis would feed normally from the mother's left breast but not turn their head to the left, allowing for normal feeding from the mother's right breast. This would result in the mother placing the child under her right axilla in a football cradle position to facilitate feeding from the right breast. Of all children diagnosed with nonsynostotic occipital plagiocephaly, 50 percent were breast-fed at 1 month, 32 percent were breast-fed at 3 months, 14 percent were breast-fed at 6 months, and 1 percent were breast-fed at 12 months. In the general population, 63 percent of children are breast-fed at 1 month, 52 percent are breast-fed at 3 months, 35 percent are breast-fed at 6 months, and 16 percent are breast-fed at 12 months.[4] When comparing the prevalence of breast-fed children in our nonsynostotic occipital plagiocephaly population with that of the general population using a chi-square goodness-of-fit analysis, a statistically significant difference was found at all ages (chi-square = 11.02; $p < 0.05$). These data demonstrate that the infants in our cohort with nonsynostotic occipital plagiocephaly were breast-fed at a significantly lower prevalence than in the general population. When those infants breast-fed with the football cradle position were excluded from our nonsynostotic occipital plagiocephaly population (n = 16), 44 percent were breast-fed at 1 month, 31 percent were breast-fed at 3 months, 14 percent were breast-fed at 6 months, and 1 percent were breast-fed at 12 months. When comparing the prevalence of our nonsynostotic occipital plagiocephaly population who breast-fed with the standard alternating left-right cradle fashion with that of the general population, a statistically significant difference was also found at all ages (chi-square = 9.06; $p < 0.05$). These data demonstrate that when those infants who were breast-fed with the football cradle position were removed from the analysis, infants in our cohort with nonsynostotic occipital plagiocephaly were breast-fed at a significantly lower prevalence than in the general population. These data indicate support for our initial hypothesis that breast-feeding may be protective against nonsynostotic occipital plagiocephaly.

Further analysis was performed investigating feeding and length of sleep. Non–breast-fed infants in our cohort slept for a longer duration than those who were breast-fed. By age, non–breast-fed infants slept an average of 4.6 hours (range, 1.5 to 10 hours) at 1 to 2 months of age, 6.4 hours (range, 2 to 12 hours) at 3 to 4 months of age, and 7.6 hours (range, 2 to 12 hours) at 5 to 6 months of age. Breast-fed infants slept an average of 3.3 hours (range, 2 to 6.5 hours) at 1 to 2 months of age, 4.8 hours (range, 2 to 11 hours) at 3 to 4 months of age, and 6.6 hours (range, 2 to 12 hours) at 5 to 6 months of age. When comparing the age groups of those breast-fed to non–breast-fed infants with nonsynostotic occipital plagiocephaly, a statistically significant difference was found for the 1- to 2-month-old age group ($p < 0.05$) and for the 3- to 4-month-old age group ($p < 0.05$). These data demonstrate that bottle-fed infants sleep for significantly longer intervals than those who were breast-fed. In addition, non–breast-fed infants slept through the night, defined as 6 hours of continuous sleep, at a younger mean age of 5 months (range, 3 weeks to 24 months) when compared with breast-fed infants at 6.97 months of age (range, 1 to 17 months) (p = 0.057). These data demonstrate that bottle-fed infants slept through the night at a significantly younger age than their breast-fed counterparts. Breast-fed children with nonsynostotic occipital plagiocephaly first presented at the clinic with an average posterior occipital deformation severity score of 5.4 (range, 3 to 8); and non–breast-fed children first presented at the clinic with an average posterior occipital deformation severity score of 5.6 (range, 2 to 8). Fifty-two percent of breast-fed children with nonsynostotic occipital plagiocephaly were successfully treated with repositioning alone, as compared with 61 percent of non–breast-fed children.

Torticollis

Of those children presenting with nonsynostotic occipital plagiocephaly, 20 percent were in addition diagnosed with contralateral muscular torticollis that correlated to the nonsynostotic occipital plagiocephaly deformity. A varied incidence of muscular torticollis in the general pediatric population has been reported in the literature ranging from 0.1 to 2.0 percent.[1,5] Conservatively assuming the incidence of torticollis to be 2 percent in the general population, when comparing the incidence of associated torticollis in our nonsynostotic occipital plagiocephaly cohort, a statistically significant difference was found (chi-square = 184.0; $p < 0.05$). These data demonstrate that our infants with nonsynostotic occipital plagiocephaly had a significantly greater incidence of torticollis than the general population. In addition, we found that 62 percent of children with torticollis failed initial conservative behavioral modification therapy, including repositioning, and progressed to cranial molding helmet therapy. When this is compared with 41 percent of those children without torticollis that failed behavioral modification therapy and that progressed to cranial molding helmet therapy, a statistically significant difference was found (chi-square = 3.12; $p < 0.05$). These data demonstrate that those infants with torticollis had a significantly greater risk of failing conservative behavioral modification therapy and progressing to cranial helmet therapy.

Multiple Gestation Pregnancies

In our cohort of children with nonsynostotic occipital plagiocephaly, 12.4 percent were born as twins and 2.9 percent were born as triplets. When compared with the incidence of twinning in the general population (2.68 percent) and the incidence of triplets (0.174 percent),[1,6] we found a statistically significantly greater number of multiple gestation pregnancies in our nonsynostotic occipital plagiocephaly population (chi-square = 37.61; $p < 0.05$).

Prematurity

In our nonsynostotic occipital plagiocephaly population, we found a 14.3 percent incidence of prematurity, as defined as birth before 37 weeks' gestation. These infants were born at an average of 3.5 weeks prematurely (range, 1 to 12 weeks). When compared with the incidence of prematurity in the general population (11.6 percent),[7] we found no significant difference (chi-square = 0.74; $p = 0.39$). These data demonstrate that in our cohort of infants, prematurity was not a risk factor for developing nonsynostotic occipital plagiocephaly.

Congenital Nonsynostotic Occipital Plagiocephaly

Congenital nonsynostotic occipital plagiocephaly is diagnosed when a child is born with evidence of occipital deformational plagiocephaly. In our nonsynostotic occipital plagiocephaly cohort, 10.5 percent were reported to have some degree of nonsynostotic occipital plagiocephaly at birth. Of these infants with congenital nonsynostotic occipital plagiocephaly, 36.4 percent failed conservative behavioral modification therapy including repositioning, and progressed to cranial molding helmet therapy. When compared with the 45.7 percent of infants diagnosed with acquired nonsynostotic occipital plagiocephaly who progressed to cranial molding helmet therapy, no significant difference was found (chi-square = 0.35; $p = 0.554$). These data demonstrate that in our cohort of infants, congenital nonsynostotic occipital plagiocephaly was not a risk factor for failing conservative therapy with repositioning and progressing to cranial molding helmet therapy.

DISCUSSION

In the early 1990s, the American Academy of Pediatrics Task Force on Infant Positioning and Sudden Infant Death Syndrome recommended that "the well newborn infant who is born at term be placed down for sleep on either their side or back." Shortly thereafter, the Back to Sleep campaign was initiated.[8] The success of this national public education campaign has led to an impressive 38 percent reduction in the incidence of sudden infant death syndrome. Concomitantly, the number of infants sleeping prone has diminished from 70 percent in 1992 to 24 percent in 1996, a significant change in infant position practices by families.[9] Paralleling the successful change in infant sleep position was an unexpected epidemic of nonsyndromic posterior occipital plagiocephaly. Despite our current clinical and radiographic understanding of this entity,[2,3] its prevention and optimal treatment strategies continue to elude us. This has piqued our interest regarding the identification of associated factors impacting the onset, treatment, and outcomes of nonsynostotic occipital plagiocephaly. Once recognized, strategies may be developed to intercede with prevention. This study investigated the social demographics, behavioral modification and helmet therapies, feeding practices including breast-feeding, associated torticollis, multiple gestation pregnancies, gestational age, and congenital nonsynostotic occipital plagiocephaly in a cohort of 105 patients identified with nonsynostotic occipital plagiocephaly.

The study population was 95 percent Caucasian, and multiple factors likely influence this finding. The pediatric plastic surgery and craniofacial clinic is the sole tertiary center serving the region, treating all patients without respect to ethnicity or socioeconomic status. It could be argued that the clinic treats a disproportionately higher percentage of minority patients and those of lower socioeconomic status. Despite this, the numbers of infants diagnosed with nonsynostotic occipital plagiocephaly in this cohort did not parallel geographic racial proportions. We suspect this may, in part, be reflective of a greater compliance with the Back to Sleep initiative within the Caucasian population. Indeed, several prospective studies have identified racial disparity in sleep positioning, wherein African Americans and Hispanic Americans were more than twice as likely to place their infants in a prone position for sleep.[10] In addition, in our cohort of supine sleeping infants, the majority of caregivers completed post–secondary education and had a mean age of 31.7 years. These findings are consistent with the report by Lesko et al.,[10] demonstrating that low educational attainment and young maternal age were risk factors associated with infant prone positioning. It is our conviction that as individuals reach higher educational levels, they delay childbearing; as a result, infants are born to relatively older caregivers who have greater access to public educational initiatives and are more likely to adopt recommendations and place their infants supine. Not surprisingly, and consistent with higher educational attainment, analysis of household incomes in this cohort revealed that 75 percent had annual earnings greater than $50,000.

Consistent with previous reports,[11–15] analysis of our nonsynostotic occipital plagiocephaly cohort demonstrated a right-sided, male preponderance. These findings may be because male infants have been found to have larger heads and tend to be less flexible than female infants,[16] making them more susceptible to compression in utero and deformational forces during delivery. The right-sided preference may result from forces exerted toward the latter period of gestation. During this period, the fetus turns and engages the birth canal, usually head down. Most often, the vertex of the head lies within the birth canal, with a left occipital anterior presentation. In this position, the infant's right occiput is compressed against the maternal pelvis. This may initiate a process that is then perpetuated by a postnatal supine positioning, resulting in the predilection to right-sided head turning[17] and allowing for an early position of comfort to be established. This position of comfort places persistent, compressive forces on the right occiput.

Treatment strategies for infants diagnosed with nonsynostotic occipital plagiocephaly include behavioral modification with repositioning and cranial molding helmet therapy. Success with conservative treatment in our study was measured by the ability to change the infant's sleep position, resulting in a correction of deformational plagiocephaly. A persistent sleep position, the cause of deformational plagiocephaly, is a learned behavior, in the much the same way as is thumb sucking. It is very difficult to change once a position of comfort has been modeled. We believe this behavior becomes nearly impossible to alter once that infant becomes 4 to 6 months of age. Therefore, depending on age of presentation, a trial of behavioral modification with repositioning is always attempted. Patients were reevaluated on a monthly basis, and success with repositioning and improvement in the deformity was monitored. If the child was successfully repositioned and improvement in the deformity was appreciated, conservative treatment was continued. If the child was unable to be successfully treated with conservative therapies and/or the deformity worsened, they were considered to have failed repositioning and helmet therapy was initiated. Studies reveal that outcomes vary and are contingent on the age of the infant when therapy is initiated and the severity of the deformity.[18] Vies et al.[19] prospectively evaluated a cohort of infants with nonsynostotic occipital plagiocephaly comparing helmet therapy with behavioral modification alone. Although both groups experienced improvement, the helmet therapy group demonstrated greater contour improvement. In our nonsynostotic occipital plagiocephaly population, 95 percent of infants were initially treated with behavioral modification therapy with repositioning. Ultimately, only 38 percent of infants were successfully treated with behavioral modification alone, and 45 percent progressed to helmet therapy. When comparing the average change in posterior occipital deformation severity of those infants with helmet therapy to those successfully treated with behavioral modification alone, a significant difference was noted, demonstrating greater improvement with cranial molding helmet therapy. A weakness of this analysis rests in the fact that the posterior occipital deformation severity score is a subjective scale and does not use objective measurements. This nonobjective analysis by the treating craniofacial surgeon may very well suffer from additional inherent bias.

The influence of feeding patterns on deformational plagiocephaly, until now, has been largely unknown. A significant amount of time in infancy, particularly during the first 6 months of life, is occupied by feeding, and this is the period when deformational forces exert their greatest effects on the neonatal skull. In addition, infants are usually positioned supine for feeds. At the onset of this study, it was our hypothesis that breast-feeding might serve as a preventative factor in nonsynostotic occipital plagiocephaly. It was our assumption that breast-fed infants feed more frequently and thereby are repositioned more frequently. In addition, breast-fed infants are naturally repositioned from side-to-side with each feed. Statistical analysis of our cohort's data indeed did demonstrate that children with nonsynostotic occipital plagiocephaly were breast-fed at a lower prevalence than in the general population. This finding supported our hypothesis that breast-feeding may be protective against nonsynostotic occipital plagiocephaly. We believe this protection may be mediated by the fact that our breast-fed population slept for shorter intervals than their bottle-fed counterparts and experienced more frequent wakening, along with natural side-to-side repositioning that breast-feeding affords. In our population, bottle-feeding resulted in longer uninterrupted sleep intervals, along with infants who slept through the night at an earlier age, compared with their breast-fed counterparts. Both of these factors contribute to a single, nonvaried head position in sleep. These findings suggest that breast-feeding may afford a distinct benefit by indirectly preventing deformation.

Associated muscular torticollis was concomitantly diagnosed in 20 percent of our infants. This was significantly higher than that reported in the general population.[20–22] Controversy exists as to which is the primary disorder: nonsynostotic occipital plagiocephaly, torticollis, or both.[22,23] A recent study looking at head shape in healthy newborns supports the theory that neck muscle stiffness evolves to secondary deformational plagiocephaly if the head is permanently tilted toward a position of comfort.[23] We believe that it is critical to diagnose this abnormality when it is present, as specific physical therapy regimens should be instituted early. Our findings show that infants with nonsynostotic occipital plagiocephaly and associated torticollis are more likely to fail behavioral modification therapy with repositioning, and progress to helmet therapy. This mandates attentive monitoring of this subgroup of infants with nonsynostotic occipital plagiocephaly and the potential early implementation of cranial molding helmet therapy, depending on the age of presentation and severity of the deformity.

Our data revealed that a multiple gestation pregnancy was a risk factor for acquiring nonsynostotic occipital plagiocephaly; this parallels the findings of other studies.[6,24,25] Twelve percent of our infants were born as twins, and 2.9 percent were born as triplets. It is suspected that intrauterine constraint likely places compressive forces on the fetus and perhaps allows the fetus to attain an in utero position of comfort that persists after delivery, setting the stage for nonsynostotic occipital plagiocephaly. Prematurity, which has had an inconsistent association with nonsynostotic occipital plagiocephaly in the literature,[6,24,25] was not identified as an independent risk factor in our population.

Congenital nonsynostotic occipital plagiocephaly is defined as occipital deformity diagnosed at birth. Ten percent of our cohort with nonsynostotic occipital plagiocephaly was found to have congenital nonsynostotic occipital plagiocephaly. It is felt that these findings evolve in utero, secondary to persistent compression of the infant's head between the maternal pelvis and the lumbosacral spine. A closer investigation of the obstetrical history of these infants, not performed in this study, may yield further answers into the cause of congenital nonsynostotic occipital plagiocephaly, perhaps identifying conditions wherein the infant was constrained in utero. When comparing those infants with congenital nonsynostotic occipital plagiocephaly to those with acquired nonsynostotic occipital plagiocephaly, no increased risk of failing conservative behavioral modification with repositioning and progressing to helmet therapy was found. It is our belief that those infants with congenital nonsynostotic occipital plagiocephaly were essentially diagnosed earlier and in enough time for behavioral modification therapy with repositioning to be effective. This stresses again the critical nature of prevention and early diagnosis of nonsynostotic occipital plagiocephaly, before the establishment of a persistent position of comfort in sleep that is incredibly difficult, if not impossible, to modify.

CONCLUSIONS

The incidence of nonsynostotic occipital plagiocephaly has risen to epidemic proportions despite its clinical and radiographic diagnosis being well established. This study demonstrates trends that may predict additional risks for developing nonsynostotic occipital plagiocephaly. These include torticollis, multiple gestation pregnancies, and an increased socioeconomic affluence that may indicate greater compliance with the recommendations for supine sleep positioning. In addition, our infants with nonsynostotic occipital plagiocephaly were less likely to have been breast-fed when compared with the general population. This has led to the belief that breast-feeding may be preventative, as breast-fed infants are repositioned more frequently and sleep for shorter periods. Also, as in other studies, we have demonstrated that cranial molding helmet therapy was more effective in correcting nonsynostotic occipital plagiocephaly than behavioral modification therapy with repositioning. This study stresses the significant importance of prevention, as primary care providers must educate new parents regarding not only the importance of supine sleep positioning but also the need to prevent a persistent sleep position that may lead to nonsynostotic occipital plagiocephaly. Finally, it is our recommendation that well-baby checks include an evaluation of head shape and head size. This will increase the likelihood of early diagnosis when nonsynostotic occipital plagiocephaly is mild and behavioral therapy with repositioning is more effective.

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DISCLOSURE

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this article.

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