

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Management of Positional Skull Deformities: Who Needs a Helmet?

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Pediatrics 2004;113:422-424

DOI: 10.1542/peds.113.2.422

The online version of this article, along with updated information and services, is
located on the World Wide Web at:

<http://www.pediatrics.org/cgi/content/full/113/2/422>

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American Academy of Pediatrics

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than sleep aids if needed. Fasting blood glucose was not obtained during the trial. There are two other long-term open-label trials^{2,3} with risperidone in this patient population. The 3 trials included a total of 688 children; only 1 case of ketonuria (severity indicated as mild) was reported in a 5-year-old boy. No action was taken, and the event resolved spontaneously during the trial. The fact that there were no adverse events related to diabetes reported in prospective studies covering 688 children for up to 1 year strengthens the lack of a causal relationship between risperidone and diabetes.

As the authors point out in their letter, MedWatch can provide signals of infrequent adverse events despite the many limitations as listed by the authors. The MedWatch database does not report type of diabetes, and it is not known whether the pediatric cases referred to were type 1 or 2 diabetes. Type 1 diabetes is an autoimmune disease and far less likely to be drug-related as well as the more common type of diabetes in children.

The emergence of diabetes mellitus in patients treated with antipsychotics involves a poorly understood and complicated mechanism that may be independent of weight gain.⁴ The hypothesis of glucose inhibition in cell lines⁵ referenced by Koller et al bears further scrutiny. Peripheral GLUT-4 transporters in muscle are insulin-regulated, whereas central nervous system GLUT-1 and -3 transporters are not. Having similar actions in both tissues by atypical antipsychotics is improbable. Animal models of homozygous GLUT-4 knockout mice do not develop diabetes but have evidence of insulin resistance. Therefore, the L6 cells would likely need to have some a priori genetic abnormality to explain the peripheral manifestations of diabetes.

In conclusion, however, we agree with Koller et al that clinicians should be vigilant with children when on any antipsychotic and institute dietary management and exercise regimens as we recommended in our original article.

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REFERENCES

1. Turgay A, Binder C, Snyder R, Fisman S. Long-term safety and efficacy of risperidone for the treatment of disruptive behavior disorders in children with subaverage IQs. *Pediatrics*. 2002;110(3). Available at: www.pediatrics.org/cgi/content/full/110/3/e34
2. Findling RL, Aman M, De Smedt G, Derivan A. Long-term safety and efficacy of risperidone in children with significant conduct problems and borderline IQ or mental retardation. Poster at Association of Emergency Room Physicians, 2002
3. Fegert J, Findling RL, De Smedt G. Interim results from a multicenter study of the long-term safety and efficacy of risperidone in children and adolescents with severe disruptive behaviors and subaverage IQ. Poster at Society for Biological Psychiatry; 2002
4. Jin H, Meyer JM, Jeste DV. Phenomenology of and risk factors for new-onset diabetes mellitus and diabetic ketoacidosis associated with atypical antipsychotics: An analysis of 45 published cases. *Ann Clin Psychiatry*. 2002;14:59-64
5. Ardizzone TD, Bradley RJ, Freeman AM 3rd, Dwyer DS. Inhibition of glucose transport in PC12 cells by the atypical antipsychotic drugs risperidone and clozapine, and structural analogs of clozapine. *Brain Res*. 2001;923:82-90

Management of Positional Skull Deformities: Who Needs a Helmet?

To the Editor.—

I read with interest an article published in the July 2003 issue entitled "Prevention and Management of Positional Skull Deformities in Infants." In my experience, positional plagiocephaly

improves within the second year of life. The authors state, however, that those requiring helmet therapy should receive it between 4 and 12 months. I would like to ask the authors how they determine at 4 months or so which kids would require helmet therapy without spontaneous resolution. Where I practice, helmet therapy is not always covered by insurance and costs thousands of dollars. I would hate to refer patients for a costly therapy if a condition is benign and transient.

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In Reply.—

Dr Lanzkowsky asked an appropriate question: What severity and at what age should helmet therapy be considered?

It is a difficult question to answer because, although there is debate about this issue, we believe there are no reliable, accurate standards to determine who should get a helmet and who should not. It is true that there is improvement in skull shape for some that occurs with time, and no additional treatment is necessary. Therefore, this approach is appropriate for this subgroup. However, it is also true that skull deformity may persist for many, and after 1 year of age, the degree of improvement is relatively slight. The bone of the skull at this time becomes more dense and mineralized and does not remodel readily. We have not seen many patients develop significant improvement in skull shape beyond 15 to 18 months of age with conservative measures (observation alone). Quite the reverse, we have seen many patients who have persistent deformity into late childhood once the deformity has persisted to ~2 years of age. The deformity in the occiput, however, is oftentimes masked by additional hair growth, and to the casual review, the deformity "has gotten better." The mainstay of treatment for improvement in skull shape relates to physical therapy so that the infant does not prefer to lie on areas in the occiput that are flattened already. If full range of motion of the neck is achieved, there is a lesser deforming influence for the skull but also, and particularly so, in the face. In truth, most if not all of us have some asymmetry in the face, and we should anticipate that a small degree of asymmetry is "normal"; what we are addressing here is minimizing the asymmetry to the level that it is not recognized as a "deformity" as the child grows older.

To determine which patients improve with helmet therapy, we attempted to use measurements of the long and short axis of the skull by calipers, but these measurements in many have been irregularly reproducible; the exact measuring points are not defined readily, and soft tissue overlying the bone (ie, the scalp) is compressible. A much more accurate method for measure would be serial computed tomography scans, but clearly this would be a significant health risk to the patient related to the repeated radiation and anesthesia/sedation exposure, as well as the significant expenditure. Laser-based measurement systems are an excellent alternative, but they are costly. Therefore, we are left with a more subjective, judgment-based analysis that includes not only physical features such as the apparent degree of skull deformity but also social factors to determine treatment. We use a crude scale of mild, moderate, and severe deformity based on the visible deformity. We also factor in how old the child is. (We know that after 1 year of age the skull is much more difficult to remodel using a helmet.) Social factors such as how much time the child is actually receiving care from the parent are also important. This may be influenced by the parents return to work and leaving the child with nonfamily caregivers. The attention paid to exercises typically is not as good as when both parents are actively involved in the care of the child in the home. Persistence of deformity also may be influenced by multiparity and willingness or ability to comply with physical therapy exercises. It may be difficult for a family member to spend sufficient time to treat the affected child (or children) due to the time requirements for care of the other children.

In summary, our treatment plan at this time is admittedly subjective because of the lack of inexpensive, reproducible, and accurate measurements. Recognition that there are varying states of maturity of bone, despite the same chronologic age (meaning that some children will be resistant to change at 1 year of age, and others will not be as resistant) and social factors such as the amount of time the caregivers are actually working on (and are

motivated to work on) the exercises to improve range of motion, is important for understanding the need for flexibility in recommending different therapies.

The cost is, or can be, high for helmet treatment; hopefully, the cost for this treatment will reduce as time passes. However, we do not think the condition is as benign from a skull deformity and social/psychological standpoint as assumed in the past.

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To the Editor.—

I read the report entitled "Prevention and Management of Positional Skull Deformities in Infants"¹ in the July 2003 issue of *Pediatrics* with interest. The American Academy of Pediatrics has provided a useful summary to primary care clinicians regarding the diagnosis, evaluation, and management of a clinical problem with an apparent sixfold increase in frequency since the implementation of the "Back to Sleep" campaign. I feel compelled, however, to comment on some practical issues that are likely to be confronted by pediatric generalists as they implement management strategies for patients who have positional plagiocephaly. Although parents in suburban practice are knowledgeable about the current sleep-position recommendations, it is apparent that these recommendations are not universally followed among providers of day-care services and within certain ethnic communities, thus demonstrating differential rates of plagiocephaly depending on the acceptance of the initial positioning guidelines. Although preventive counseling, mechanical adjustments, and exercise are logical interventions, there is a surprising reluctance for parents to position their children in a supine fashion, even when the children are awake. If clinicians accept that most children do not have a true restrictive torticollis, there may still be some resistance to motion as the caretaker attempts to move the infant's head through a 180° arc. This statement would have been additionally helpful if it had recommended an increased frequency of visit follow-up to assure compliance with and improvement from an exercise program. A particularly distressing personal experience has been the seeming unwillingness of pediatric physical therapists to train or encourage parents in an appropriate exercise-management program.

If we postulate that children with craniosynostosis are diagnosed and managed correctly, then the need for surgery and orthotic devices should be comparatively low. The literature for orthotic-device outcomes is surprisingly thin, shows only modest improvement effects over nonmechanical interventions, and is largely generated by individuals directly involved in the manufacture of cranial remodeling devices. Review of the approval of such devices on the Food and Drug Administration website (www.fda.gov) reveals a similar dearth of references as to the effectiveness, safety, and usefulness of these orthotic devices. There is an evolving literature that suggests that children with occipital plagiocephaly have large heads and increased Sudbury fluid between the skull and meninges. There is also speculation that this fluid may lead to a greater risk of plagiocephaly due to the nondeformability of this fluid relative to other cranial structures.² Although there is limited anecdotal information from pediatricians about side effects from such cranial orthotic devices (pressure sores, local irritation, increased irritability, and odor issues), visits to parent support web sites for "Plagio babies" reveal the range of difficulties that parents have leaving the helmets on for 23 hours a day over several months. Finally, there is some speculation in the neurosurgical community that children with external hydrocephalus and consequent positional plagiocephaly may be at greater risk for serious head trauma from seemingly minor injuries. Although there are no data that suggest that the use of cranial-remodeling devices leads to direct intracranial injury, it is difficult not to speculate that the application of steady pressure, for an extended period of time, to a cranial axis with some deformable and nondeformable structures would not have some potential effect beyond simple reshaping of the infant head. Such speculation would seem to suggest a potential research alliance between pediatric generalists and specialists and mechanical engineers with an understanding of fluid dynamics. As the

number of children with this condition continues to increase, the recommendations of the American Academy of Pediatrics and its potential guidance for future research endeavors will assume a level of paramount importance.

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REFERENCES

1. Persing J, James H, Swanson J, et al. Prevention and management of positional skull deformities in infants. *Pediatrics*. 2003;112:199–202
2. Sawin PD, Muhonen MG, Menezes AH. Quantitative analysis of cerebrospinal fluid spaces in children with occipital plagiocephaly. *J Neurosurg*. 1996;85:428–434

In Reply.—

Dr Rappo describes a number of points regarding the management of infants with plagiocephaly. First, he states that there is a variable degree of compliance with supine positioning for sleep by different groups, day-care providers, and ethnic groups. We agree that this is the case, and we have outreach programs that describe both the importance of supine positioning for sudden infant death syndrome prevention and avoidance of skull deformity. We have not encountered the same degree of resistance among physical therapists who teach the exercises. Rather, there are a number of competing exercise programs that individual therapists seem to advocate. Regardless of the type of technique, the basic components relate to stretching muscles that are abnormally shortened to include the lateral neck musculature and the sternocleidomastoid. Monitoring of this clearly needs to be done either through the pediatrician's office or a combination of the physical therapist's office and a craniofacial-team program.

It is true also, as Dr Rappo has noted, that literature related to orthotic devices is scant, and the outcomes are relatively difficult to discern. This largely relates to the inaccuracies of the measuring tools currently available for measuring the skull shape. As has been mentioned earlier, the skin surface "cephalometric" measurements are not terribly reliable, related to the lack of an absolute cephalometric point from which to measure and the fact that soft-tissue components overlie the bony landmarks. This could be obviated by doing computed tomography scans. However, the risk of repeated radiation exposure, anesthesia and sedation, and cost for the child outweigh the potential benefits of this analysis (at least on a widespread basis). Laser measurements that have been developed for 3-dimensional imaging do show the prominence of these measurements without the added risk of radiation. However, the tools are very expensive, but they may be used primarily for developing standards and efficacy in a research setting.

Macrocrania with or without external hydrocephalus has been associated with a higher incidence of plagiocephaly in clinical practice. Presumably this is related to the fact that it is harder to lift a heavier head with immature neck muscles than it is a smaller head. The concern related to intracranial effects of a helmet on brain development is untested as yet. Although it is remotely possible that there could be some internal effects related to selective pressure on high pressure points on the skull, one has to remember that in addition, there is selectively less pressure in areas of flattening. The amount of pressure delivered by helmets, generally, is also extraordinarily low. It is not significantly different from that which the child receives when lying on the back of the head going to sleep. We think the major point is that this is unknown and could be investigated further. In any study design one would also have to sort out preconditions such as prematurity and primary neurologic disease (which may predispose a child to plagiocephaly) among other conditions before conclusions could be drawn.

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To the Editor.—

The recent clinical report in the July 2003 issue of *Pediatrics* "Position and Management of Skull Deformities in Infants" is interesting and informative. It is intriguing that the simple policy of babies sleeping on their backs can have such a profound effect on decreasing sudden infant death syndrome (SIDS). One cannot help but wonder what other factors in our lives may be causing a significant illness or morbidity. We have learned that changing the sleeping position to decrease SIDS causes another abnormality—positional skull deformity. This is an easy trade-off that we gladly accept to prevent such a horrendous illness as SIDS.

I propose that there is another pediatric abnormality that is affected by the "Back to Sleep" policy but in a favorable manner. This is metatarsus adductus, a once-common finding on routine physical examinations but now, in my experience, very uncommon. With children now sleeping on their backs, the feet are free to assume the normal position, dictated by normal growth after being cramped and possibly adducted in utero. When babies sleep on their abdomen, the feet are often tucked inward due to the normal flexing of the hips, knees, and ankles. This puts inward torsion on the forefoot, which promotes it to become adducted or to maintain the previous in utero-acquired adduction. Colleagues whom I have informally queried agree with the decreased incidence of metatarsus adductus. Studies could and should be done to confirm and quantitate this decrease.

Once again, if confirmed, this makes us aware that changes we may recommend in one's life may affect other aspects that are unanticipated. As guardians of children's health, we should always be alert to this possibility.

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In Reply.—

We have little comment on the letter by Dr Martin Stallings, because we did not study this condition.

However, a number of colleagues have noted a similar reduction in incidence of metatarsus adductus with the supine sleep-positioning recommendations. It might be worth additional, separate study to clarify the issue further.

We would caution Dr Stallings, however, that one of the main points of the paper was not that we should accept a skull deformity for anti-sudden infant death syndrome (SIDS) development. (Dr Stallings notes that we would readily accept some deformed skulls in order to reduce the likelihood of SIDS.) We would agree if this were the only alternate option. However, we can largely prevent skull deformity by simple measures such as alternating the head position on a nightly basis from the first day of life and still get the benefit of supine positioning-related SIDS reduction.

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Maternal Depression and the Pediatrician

To the Editor.—

One of the 3 "overarching goals" of the Future of Pediatric Education (FOPE) II is "to recommend essential changes in the educational process to meet the current and future health care needs of all infants, children, adolescents, and young adults."¹ The FOPE II Executive Summary notes that "prevention is a core value for pediatricians," and it describes the well-child visit as "a vehicle for focusing on immunizations and it allows pediatricians to promote healthy lifestyle choices, to monitor patients for physical and behavioral pathology and to provide age-appropriate and individualized anticipatory guidance."¹ It also notes that "one negative trend over the past two decades has been the increased number of children living below the poverty line."¹ In 2000, 17% of children lived in families with income below the poverty line²; however, 41% of children living in female-headed households live in poverty.³

Although the association between poverty, marital status, and women's depressive symptoms is well described in the literature,^{4,5} there is no explicit statement within the FOPE II report that parents' mental health affects children and should be monitored as an important screening activity included during well-child visits. In fact, 43% of pediatricians in a recent survey did not believe it was their responsibility to identify depressed mothers.⁶

Of course, it is well established that high levels of depressive symptoms in mothers of young children are common and correlate with a number of morbidities in their children.⁷ For example, the National Survey of Families and Households⁸ was administered to a national probability sample of 13 007 adults interviewed in 1987–1988 (wave 1) and 10 005 adults reinterviewed in 1992–1994 (wave 2). There were 2380 African American, Hispanic American, and European American mothers interviewed in wave 2. "Mothers" were <50 years old with at least 1 child (biological, adopted, step, or foster) <19 years old living at home. A validated 3-item depression screen⁹ was included in the survey. The items address the amount of depressive symptoms in the past week, 1 year, and throughout the life of the respondent. If 2 of the 3 items are scored "positive," then the screen is scored positive.

The overall rate of a positive screen was one third of study mothers. Furthermore, single-parenthood was a significant risk factor for a positive screen. Almost half (47%) of unmarried mothers had a positive screen, and approximately one quarter of unmarried mothers had the maximum score of 3 on the depression screen, indicating depressive symptoms in the past week, at least 2 weeks in the past year, and at least 2 years during their life. This high rate of maximum depression-screen scores was reported by unmarried mothers in income subgroups both below and above poverty level.

Given the high rate of maternal depressive symptoms and their well-documented adverse impact on the growth and development of children,^{4,7} the leaders of FOPE II have an excellent opportunity to include the early identification and treatment of maternal depression as an important objective in the education of future generations of pediatricians as we all strive to address effectively "the future health care needs of all infants, children, adolescents, and young adults."¹

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REFERENCES

1. The Future of Pediatric Education II: Organizing pediatric education to meet the needs of infants, children, adolescents, and young adults in the 21st century. A collaborative project of the pediatric community. Task Force on the Future of Pediatric Education. *Pediatrics*. 2000;105:157–212
2. Population Reference Bureau. 2000 Census data: Key facts for United States. Available at: www.aecf.org/cgi-bin/aecensus.cgi?action=profileresults&area=1. Accessed August 29, 2003
3. Population Reference Bureau. 2000 census data: living arrangements profile for United States. Available at: www.aecf.org/cgi-bin/aecensus.cgi?action=profileresults&area=1&printerfriendly=0§ion=4. Accessed August 29, 2003
4. Lanzi RG, Pascoe JM, Keltner B, Ramey SL. Correlates of maternal depressive symptoms in a national Head Start program sample. *Arch Pediatr Adolesc Med*. 1999;153:801–807
5. Brown GW, Moran PM. Single mothers, poverty and depression. *Psychol Med*. 1997;27:21–33
6. Olson AL, Kemper KJ, Kelleher KJ, Hammond CS, Zuckerman BS, Dietrich AJ. Primary care pediatricians' roles and perceived responsibilities in the identification and management of maternal depression. *Pediatrics*. 2002;110:1169–1176
7. Weissman MM, Jensen P. What research suggests for depressed women with children. *J Clin Psychiatry*. 2002;63:641–647
8. Sweet JA, Bumpass LL. The National Survey of Families and Households—Waves 1 and 2: data description and documentation. University of Wisconsin, Madison, WI; Center for Demography and Ecology: 1996. Available at: www.ssc.wisc.edu/nsfh/home.htm
9. Kemper KJ, Babonis TR. Screening for maternal depression in pediatric clinics. *Am J Dis Child*. 1992;146:876–878

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