Occipital plagiocephaly: a critical review of the literature

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Object. The literature on occipital plagiocephaly (OP) was critically reviewed to determine the feasibility of establishing treatment recommendations.

Methods. Using standard computerized search techniques, medical literature databases containing peer-review articles dating from 1966 were queried for key words related to OP. The titles of all articles were scanned for relevance, and copies of potentially relevant articles published in English were reviewed. Articles in which treatment was discussed were categorized according to their weight of evidence as Class I (prospective randomized controlled trials), Class II (clinical studies in which data are collected prospectively or retrospectively based on clearly reliable data), and Class III (most studies based on retrospectively collected data) to evaluate their contribution to developing a consensus on the treatment of OP.

Of the 4308 articles identified, all but 89 were excluded. Based on the review of these articles, the actual incidence of OP is unknown, and no population-based studies of its incidence or prevalence exist. The reported incidence of lambdoid craniosynostosis ranges from 3 to 20% with differences in diagnostic criteria accounting for the variability. With the possible exception of a lambdoid suture that is replaced by a dense ridge of bone, no other diagnostic criteria have been agreed on. There were no Class I studies and only one Class II study provided comparisons of outcomes in more than one treatment group with outcomes in an untreated group. Recommended treatment options included observation only, mechanical interventions, and a variety of surgical techniques.

Conclusions. Controlled clinical trials are needed before any form of intervention can be recommended for the treatment of OP. If surgery, which is expensive and potentially dangerous, is to continue to play a role in the management of this condition, efforts should be made to determine if patients with untreated OP have suffered from lack of treatment.

KEY WORDS • asymmetry • cranial suture • lambdoid craniosynostosis • plagiocephaly • torticollis

Clinical Material and Methods

Techniques developed by the Head Injury Guidelines Task Force\(^{19}\) were used to conduct a computerized literature search of standardized medical databases containing peer-reviewed articles dating from 1966. The key words used in this search included: “lambdoid,” “craniosynostosis,” “cranial sutures,” “plagiocephaly,” “facial asymmetry,” and “torticollis.” The list generated by this search was scanned by title, and articles of interest were identified. The abstracts and reference lists of these articles were reviewed to refine the list further. After a final selection was made, the articles of interest were obtained from the medical library at St. Joseph’s Hospital and Medical Center, Phoenix, Arizona, or from other institutions by interlibrary request.

Each article was scrutinized for content and, if appropriate, assigned as relevant to one or more of the following topics: incidence, diagnostic techniques, late complications, treatment, and pathophysiology. Those assigned to the treatment category were subdivided according to the type of treatment advocated, including observation,
repositioning and exercises, helmet therapy, and surgery. Each study in which a certain treatment was evaluated or discussed was further categorized according to the type of evidence that it represented: Class I (prospective randomized controlled trials); Class II (clinical studies in which the data were collected prospectively or retrospectively analyses based on clearly reliable data); or Class III (most studies based on retrospectively collected data). Topics such as incidence, which could not otherwise be categorized, were evaluated in terms of the appropriateness of the study’s experimental or statistical design and the study was then compared with other articles on the same topic.

Results

The initial search generated 4308 articles, of which 89 were relevant. The key word “plagiocephaly” generated 52 of these articles. Several related references were discovered through citations in these articles.

The lack of agreement concerning definition of terms among authors hindered categorization of the articles. Until recently, most articles in the neurosurgical literature equated the term “plagiocephaly” with “unilateral coronal craniosynostosis,” a condition not dealt with in this review. Articles written primarily for pediatricians used the term “plagiocephaly” to mean the parallelogram shape of the head that we usually associate with OP. These terms are not defined in articles written by ophthalmologists, dentists, and dysmorphologists. Typically, such articles focus on unilateral coronal craniosynostosis, but the type or cause of the plagiocephaly is seldom specified, leaving the reader to identify the entity. Consequently, the first finding of this review is that there is a great need for uniform nomenclature in the literature.

Incidence of OP

Ten articles in which the incidence of OP or lambdoidal craniosynostosis was reported were identified. Two of these studies were population-based studies in which the results were compared with those of previous publications. In one of these studies, a 5.5% incidence of lambdoid craniosynostosis was reported in a population of infants born with any type of craniosynostosis. The overall incidence of craniosynostosis, according to this study, was six cases per 10,000 live births. The second population-based study, which was performed in Olmsted County, Minnesota, listed the incidence of confirmed cases of craniosynostosis to be 3.1 cases per 10,000 births and 13.6 suspected cases per 10,000 births. Based on these studies, plagiocephaly from isolated lambdoid craniosynostosis should occur approximately three times in 100,000 births (0.003%, or approximately 100 times less frequently than myelomeningocele).

Of 404 cases managed for craniosynostosis at the Hospital for Sick Children in Toronto between 1972 and 1984, Muakkassa and colleagues considered 74 patients (18%) to have premature closure of the lambdoid suture. Compared with the aforementioned studies, the difference in incidence seems to reflect the authors’ definition of lambdoid craniosynostosis. In only three of the 74 patients was the suture found to be pathologically fused, the definition likely used in the other studies. The remaining 71 patients probably suffered from OP. If incidence is recalculated on the basis of this conclusion, pathologically distinct lambdoid craniosynostosis occurred in three of 333 children with craniosynostosis, or less than 1% of craniosynostosis treated at that institution.

According to Dunn, the incidence of OP is one in every 300 live births and its most likely cause is sternomastoid torticollis; this author postulated that both conditions are caused by constraint in utero. Dunn’s figure is quoted in subsequent articles by Clarren and coworkers; my literature search revealed no population-based studies from which incidence data could be derived. In an attempt to define a population for whom intervention would be justified, Clarren and coworkers have stated that approximately 10% of these children may be left with permanent disfigurement. How that percentage was calculated is not explained, rendering the actual percentage of this population in need of treatment unknown.

Plagiocephaly can be common among otherwise normal patients who are unaware of their condition. Using an apparatus of articulated rulers, Watson measured 214 patients who had congenital disorders that are highly associated with plagiocephaly, including congenital hip dislocation, bat ears, congenital scoliosis, and sternomastoid tumors. Quantifiable plagiocephaly, present in 60% of infants with congenital hip dislocation, decreased to 32% by adolescence. In a control group of 485 patients, Watson found that 48% of the normal healthy infants less than 1 year old had significant degrees of asymmetry as did 14% of the normal adults (including some of the parents of the children with congenital hip dislocation).

Pathophysiological Determination of OP

There is a consensus about the pathophysiological mechanism of OP: an external force applied consistently to a specific region of an infant’s head over a long period deforms the skull. Both prenatal and postnatal factors are involved in the distortion and some conditions may predispose an infant to OP.

Watson evaluated 214 referred children of all ages who had OP in addition to their presenting complaints of congenital hip dislocation (107 children), congenital scoliosis (48 children), sternomastoid tumors of infancy (SMT) (42 children), and bat ears (17 children). In the latter condition, a somewhat deformed ear is more prominent than the uninvolved ear and can be returned to a more normal position through manipulation. The deformed appearance of the ear, which is on the flattened side of the head, may reflect a forward and downward position related to the cranial deformity. Both congenital hip dislocation and bat ears are caused by prenatal constraint of the fetus and are common in the context of oligohydramnios and multiple births. These two associations also suggest that plagiocephaly results from prenatal factors that constrain the head of the fetus within the maternal pelvis.

In contrast, congenital scoliosis and SMT result from constantly turning the head in the same direction. Although prenatal factors may exist, it is more likely that these conditions cause significant plagiocephaly postnatally, particularly if the child sleeps supine. Of the 48 patients with congenital scoliosis, 11 had distinct vertebral body anomalies that caused constant head rotation.
Watson described the side of the plagiocephaly as the posteriorly displaced side with a flattened forehead and bulging occiput. The left/right ratio of plagiocephaly was 2:1. All other authors define the side of the plagiocephaly as the side of the flattening of the occiput and secondary forehead bulging. When this difference is considered, the incidence of side-to-side preference agrees with that reported by most contemporary authors, who likewise found a consistent right/left preference of 2:1. 

Congenital muscular torticollis is often cited as a cause of plagiocephaly. The degree of the torticollis tends to be mild and is manifested as a preference for one-sidedness. Slate and colleagues evaluated 30 infants for congenital muscular torticollis. Twenty-six of these patients had OP, 13 of whom exhibited rotary subluxation of C-1 onto C-2 on computerized tomography (CT) scanning. None of the 26 patients required cervical fusion, although seven infants required neck-muscle surgery to improve their plagiocephaly. Although this rotational difficulty may begin prenatally, its continuing presence may increase the severity of OP during the 1st year of life.

With the exception of patients who have serious congenital anomalies of the spine that cause severe mechanical scoliosis (which may be fixed and to some extent untreatable), the most severe form of congenital muscular torticollis is caused by SMT and may persist into adulthood. In a large percentage of patients, the torticollis is also associated with severe OP.

In SMT, an actual mass of hypertrophic scar tissue is palpable in the belly of the muscle; perhaps this is caused by venous infarction of the muscle related to intrauterine constraint. The SMT usually responds to physical therapy such as stretching exercises. Occasionally, however, it is so severe that the mass must be removed. Surgical treatment of the neck muscles usually improves the associated OP.

If torticollis that is associated with SMT or congenital spinal deformity is untreated during childhood, the resulting facial deformity may be severe enough to be a problem for adolescents and adults. Ferguson reported on three adults with severe torticollis and OP. After physical therapy failed, these patients’ facial asymmetry was corrected by maxillary osteotomies. These three patients and five others reported by Ferguson all had severe, obvious cervical scoliosis that remained untreated into adulthood. These eight patients were the only individuals identified in the literature search who later in life required treatment for facial asymmetry related to OP.

Occipital plagiocephaly also occurs in patients with asymmetric brain injuries or developmental abnormalities associated with severe asymmetric spasticity or major unilateral motor epilepsy and in individuals whose skulls have been deformed intentionally. Strabismus, especially involving vertical eye movements, is common in patients with severe OP but is more likely a result rather than a cause of the OP. Congenital paresis of the superior oblique muscle leads to strabismus and head tilt in the first 6 to 12 months of life and may be associated with secondary facial asymmetry. In contrast, traumatic palsies of the superior oblique muscle do not lead to secondary facial deformity. Goodman, et al., have postulated that early correction of strabismus related to congenital weakness of the superior oblique muscle may improve the resultant facial asymmetry, but positioning and neck-stretching exercises are probably more important. In their series no older children or adults required intervention for their facial deformities.

Consistent with prenatal restrictions of skull movement, many infants with OP have heads that are either large for their gestational age or frankly macrocephalic. Sawin and colleagues compared CT findings in 31 infants with OP with those in 20 normal children. Of the 31 infants with OP, 29 exhibited the generalized increase in subarachnoid cerebrospinal fluid associated with macrocephaly (external hydrocephalus). The authors conjectured that the excess of cerebrospinal fluid predisposes infants to calvarial distortion because the shifting fluid increases the plasticity of the skull. It is also possible that the larger the head, the more likely the child is to have external hydrocephalus and, independently, to suffer plagiocephaly if constrained in utero.

Diagnostic Studies

Which diagnostic tests need to be performed and how they should be interpreted are highly controversial issues, reflecting two different philosophical approaches to the treatment of OP. The first perspective, that of classic neurosurgical teaching, is that craniosynostosis is a progressive disease and that a skull deformity increases as the brain grows. Consequently, a primary goal of therapy is to prevent the deformity from worsening, and an accurate diagnosis of craniosynostosis becomes critical.

The clinical and radiographic criteria for true lambdoid craniosynostosis have not been established, although some authors, myself included, have considered this condition to have features distinctive from other forms of craniosynostosis. Based on this perception, a small percentage of the patients reported actually has radiographic or pathological evidence of sutural closure and the usual palpable or visible ridging. At surgery, the undersurface of the suture is observed to be fused with the underlying dura, a feature that is absent in other forms of craniosynostosis. True lambdoid craniosynostosis is exceedingly rare, and radiographic investigations for its diagnosis are justified. In contrast to OP, the side of occipital flattening is ipsilateral to the forehead flattening, creating a rhomboid instead of a parallelogram. A prominent ridge is easily palpated in the area of the mastoid bone or is observed on CT scanning. Unless these features are present, surgical treatment to prevent further worsening of the deformity is not justified.

When viewed from the second perspective, whether a patient has craniosynostosis is immaterial. The decision to treat a deformity depends on the degree of functional and cosmetic deformity. From this perspective, the distinction between lambdoid craniosynostosis and postural OP loses its significance. The importance of diagnostic studies devolves to studying the results of treatment and comparing patient outcomes or forms of treatment.

Before the advent of CT scanning, Watson advocated using articulated rulers to measure the degree of asymmetry of the skull. This simple, inexpensive method detects asymmetries in both obviously affected and normal individuals. However, no data on the interrater reliability of the technique are available. If such data became available,
the technique could decrease the cost of long-term follow-up studies.

Sophisticated technological procedures also have been advocated for the diagnosis of various forms of plagiocephaly. For example, Glat and associates\textsuperscript{12} developed a three-dimensional computer analysis of measurements obtained from CT scans and discerned three distinct types of plagiocephaly: synostotic plagiocephaly, deformational plagiocephaly, and plagiocephaly associated with hemifacial microsomia. Although their work is in progress, they hope to establish objective criteria for intervention.

Lo and colleagues\textsuperscript{23} studied configurations of the skull base on three-dimensional CT reconstructions. One interpretation of their data is that true synostosis, whether coronal or lambdoid, will produce changes that reflect rotation of the skull base elements around an axis located in the quadrilateral space bounded by the anterior and posterior clinoid processes. In the case of external deformation (as in OP) the calvaria, but not the central skull base, rotates around this axis. If their hypothesis is correct and craniosynostosis causes the distortion, a line drawn down the crista galli and passing through the midpoint of the skull base will not pass through the center of the foramen magnum and may miss it altogether. In contrast, in cases of postural skull distortion, only the calvaria and the most lateral rays of the sphenoid and petrous bones would be displaced, and the line would pass near the center of the foramen magnum.

Lo and colleagues\textsuperscript{23} developed mathematical descriptions of these findings, which if adopted, will improve the concurrence among radiologists who interpret the radiographs. To review their work critically we would have to know whether the four patients they describe as having unilateral lambdoid craniosynostosis met the aforementioned criteria for that diagnosis.\textsuperscript{16} In contrast with the complicated techniques described by Glat and coworkers\textsuperscript{12} the principles outlined by Lo and colleagues are simple and easy to follow and probably could be implemented consistently across centers. Although these techniques may help determine whether true synostosis exists, they do not appear to differentiate the degree of severity of OP across patients or in the same patient before and after treatment.

Late Effects of OP

Except for the management of a small number of patients with overt lambdoid craniosynostosis, neurosurgeons have played little or no role in managing OP until recently.\textsuperscript{15,22} To evaluate the importance and effects of interventions, whether mechanical or surgical, the natural history of the untreated condition must first be understood. Establishing the natural history of OP should be feasible because few infants received treatment before the late 1970s.\textsuperscript{23,34,38} Consequently, many adults should have residual evidence of untreated OP.\textsuperscript{24} In fact, Watson’s study,\textsuperscript{26} described earlier, demonstrated that adults do have OP. Studying any negative effects suffered by such adults would help to define the risks associated with nontreatment. A concerted effort, therefore, was made to identify studies in which adolescents and adults with untreated OP were evaluated later in life.

Anterior plagiocephaly (unilateral coronal craniosynostosis) is well known to produce significant abnormalities in binocular eye movements. Limon de Brown and colleagues\textsuperscript{22} used anthropometric measurements to study the relationship between plagiocephaly and strabismus. Although they do not mention the total number of patients who were screened and their techniques are not described thoroughly, given that 13 patients had moderate-to-severe orbital dystopia (untreated coronal craniosynostosis), the total number of patients must have been large. These authors’ published figures indicate that their moderate-to-severe cases were representative cases of untreated unilateral coronal synostosis. The six patients whom they term “minimal” likely have OP. These patients did demonstrate strabismus, but their visual acuity and binocular vision in primary position were normal. None of these patients was aware of having an asymmetric head. The authors suggest that asymmetry associated with minor degrees of OP may cause strabismus to develop. Because the total number of patients screened in this study is unknown, whether the two diseases coexist independently or are related causally cannot be determined. However, the effect on the patients’ lives was minimal and the problems were identified only by compulsory screening techniques.\textsuperscript{22}

In only one study were the effects of synostotic and deformational frontal plagiocephaly on ocular motility and strabismus compared.\textsuperscript{8,9} Deformational frontal plagiocephaly seems to be another synonym for the more severe forms of OP associated with compensatory changes in the forehead and face. Fredrick and colleagues\textsuperscript{10} studied 13 patients with deformational frontal plagiocephaly. One patient had horizontal strabismus unassociated with the geometry of the head tilt; this was considered an incidental finding.

Facial asymmetry causes significant problems for dental management, especially orthodontia and difficulties with the temporomandibular joint. Cross-referencing the terms “plagiocephaly” with “facial asymmetry” yielded one article, written from the perspective of an oral surgeon, in which a problem caused by plagiocephaly was described. A woman was told that one side of her face was swollen although she had experienced no pain and had been unaware of the problem.\textsuperscript{29} An extensive workup revealed only a previously unrecognized plagiocephaly, which photographs of the patient confirmed had existed since early childhood.\textsuperscript{29}

With respect to physical characteristics, being perceived as “abnormal” by peers, especially during adolescence, is always a compelling reason to consider intervention. Based on this literature search, it is unlikely that this issue has been studied in the context of OP. Parenthetically, after extensive searching and advertising to rather large groups, I identified and interviewed two men with severe residual OP. One of them had been teased as an adolescent, but neither felt that the asymmetry had caused significant social problems. Before aggressive intervention can be recommended, the effect of OP on the lives of adolescent and adult patients should be determined.

The possibility exists that cranial distortion, without increased intracranial pressure or definable damage to the distorted underlying areas of the brain, could lead to overt...
or subtle neuropsychological problems. This effect, however, has not yet been reported.

Treatment for OP

Three categories of treatment are available for OP: 1) expectation/observation/reassurance with or without minor mechanical intervention; 2) aggressive mechanical intervention with or without cranial banding; and 3) surgery. Most infants with OP likely have either gone unrecognized or been treated expectantly, usually by reassuring the parents and instructing them to place the bulging side of the infant’s head toward the crib mattress. Unfortunately, there have been no follow-up studies of patients treated in this way and no population-based incidence studies have included an evaluation of the natural history of the untreated condition.

Aggressive mechanical intervention involves an active diagnosis of OP and reversal of the forces that distorted the head. Interventions include neck-stretching exercises, with or without the supervision of a physical therapist, and active attempts to modify the child’s sleeping position. One report of this approach (Class III evidence) showed measurable improvement in cranial asymmetry.14

Currently, aggressive mechanical intervention mostly refers to the use of the cranial remodeling helmet or dynamic orthotic cranioplasty. In two articles, Claren and coworkers6,14 originally reported the use of helmet therapy in the treatment of OP. These two studies overlap to some extent. The four patients reported in the article published in 1979 were also included in the group of 28 patients reported in the follow-up study (Class II evidence). By using a subjective numerical scoring scale, the outcome of 25 patients who completed treatment was compared with those who refused or did not complete treatment. Of the 25 treated patients, 19 achieved a normal appearance and all improved. Of the patients who refused or failed to complete treatments, seven showed no improvement whereas six improved slightly. Who made the assessments and at what time were not stated. Although flawed methodologically, this study supports the use of helmets to correct deformational abnormalities of the skull.7

Ripley and colleagues20 described the use of helmet therapy (dynamic orthotic cranioplasty band) in 124 infants and children who were observed by periodically obtaining extensive anthropometric measurements (Class III evidence). Anthropometrically measured asymmetry improved significantly in all but a few patients. The corrections were maintained after use of the band was discontinued, but no further improvements were observed in these patients. The authors of that study claimed that OP does not improve without this type of intervention but supplied no data to validate the statement.

In patients with OP who were treated without the band, Moss18 obtained measurements similar to those of Ripley and colleagues.20 Moss’ review was not detected by the literature search and thus, technically, was not included in this critical analysis. Like Hellbusch, et al.,14 however, Moss found that mechanical interventions that did not include the use of the band may be useful in the management of OP.

Surgery for OP, ranging from unilateral strip craniectomy6,15,25 to extensive bilateral occipital cranial remodeling techniques that expose the entire torcular and both transverse sinuses, is still advocated at a number of centers.18,26 Three such studies produced Class III evidence, and all relied on subjective assessments of success in the early postoperative period. Dias, et al.,26 studied 30 infants who had undergone strip craniectomy of the lambdoid suture for OP and attempted to measure the degree of asymmetry from CT scans (Class III evidence). The CT scans, obtained 3 months to 4.2 years after surgery, were available for only 18 of the patients. These measurements showed significant improvements; however, significant differences still remained between the surgically treated group and the normal control group.

Discussion

Incidence of OP

Before the actual incidence of OP can be ascertained, a consensus on its diagnostic criteria is needed. Although undetermined, the incidence of OP is likely to be high. The often-quoted incidence of one in every 300 live births7 is a low estimate that reflects variations in defining and diagnosing the condition. The incidence of isolated unilateral lambdoid craniosynostosis ranges from less than 1% to approximately 5% of patients with craniosynostosis. These estimates imply that the population-based incidence should be less than three cases per 100,000 births. Estimates as high as 20% for craniosynostosis related to unilateral involvement of the lambdoid suture have almost certainly used broad radiographic criteria that resulted in a majority of patients being diagnosed with OP. These issues must be clarified so that subsequent work can distinguish between lambdoid craniosynostosis and OP.

At least one report20 contains the suggestion that the increase in referrals of patients with OP reflects the 1992 American Academy of Pediatrics’ recommendation to position sleeping infants supine to prevent sudden infant death syndrome. Because OP is primarily a mechanical problem related to positioning and because most children who received a diagnosis of OP before this recommendation was made did not tolerate prone sleeping, this assumption is logical. Beginning in 1992, Kane and colleagues20 reported a six-fold increase in the annual number of referrals to their craniofacial center compared with the previous 13 years. However, greater physician and public awareness of the condition also may have played a major role in the increase in referrals.17

Pathophysiological Determination and Diagnosis

Occipital plagiocephaly is associated with many conditions that lead to a unifying pathophysiological entity. Either because of their external environment or intrinsic abnormalities of their posture (such as SMT, cervical spine anomalies, or asymmetric tone), infants with OP lie in the same position for long periods. Consequently, an area of the skull becomes distorted by a hard, flat surface, either the maternal hip bone prenatally or a crib mattress postnatally. Similar to the scaphocephaly that develops when an infant with massive hydrocephalus undergoes ventriculoperitoneal shunting, a persistent deforming force at the lambdoid suture may produce radiographic

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evidence of lambdoid craniosynostosis in patients who otherwise exhibit the characteristic findings of OP.

The best diagnostic test for OP remains the physical examination, which only requires that clinicians look down at the top of an infant’s head. Asymmetry in the position of the ears and flatness of the occiput are visible by this simple and inexpensive technique, which can be performed in less than a minute. If detected in the first week of life and mechanical means are instituted to counteract the distortional effects, the questions of whether to intervene later and, if so, how become moot.

Formal measurement of standard anthropometric lines should prove useful in assessing the severity of OP. A learning curve is associated with the use of calipers, and interobserver concurrence is poor until observers acquire considerable experience. However, comparing the measurements of experienced observers offers a reasonably inexpensive and reliable method to compare the severity of OP across patients before and after treatment.

Late Effects of OP

If rigorously investigated, facial asymmetry can be found in a relatively large number of adults. Plagiocephaly severe enough to be acknowledged by patients themselves appears to be exceedingly rare. Occipital plagiocephaly only requires treatment in patients with overt and untreated congenital muscular torticollis, a condition so rare that it warrants careful study and publication of findings.

Several caveats, however, are necessary. The theoretical problems of visual disturbances and orthodontic/oral surgical difficulties were not supported by this analysis. They could exist but be unreported, or they may have eluded this search because variations in jargon among different specialties were not recognized. To test this hypothesis in a preliminary fashion, I informally discussed the late effects of OP with a number of professionals who might encounter such patients. Although these interviews were unscientific, pediatric orthopedists, orthodontists, oral surgeons and barbers/hair stylists did not recognize OP as a problem with which they were required to deal. Only oculists exhibited awareness of the condition because they often adjusted glasses so that one ear piece was shorter than the other. The dental literature should still be searched to determine whether untreated patients with this condition require special attention later in life.

Treatment Standards

Before principles of treatment for infants can be established, the effects of nontreatment on affected adults, who appear to be numerous, must be determined. Because available data are insufficient, only general guidelines can be formulated for the available options. If begun early in life and performed consistently, mechanical interventions, such as propping a child and neck-stretching exercises, can help prevent OP from worsening and may help to reverse a deformity partially. In patients with moderate-to-severe degrees of OP, helmet or band therapy may improve the observed and measurable asymmetry that persists despite mechanical intervention. The earlier the helmet or band is applied, the quicker and more complete will be the correction. This option should be used before surgical intervention is considered for patients recognized with OP in the 1st year of life. The degree of deformity, however, that necessitates this treatment cannot be determined from the available studies. Finally, data are insufficient to support guidelines related to the surgical management of OP. For patients who exhibit severe residual deformity after headband or helmet therapy or for those referred after 1 year of age, surgical intervention may be considered. If surgery is to be performed for OP, several techniques may be effective, but no compelling evidence supports one technique over another. Because little information about the true risks of leaving this condition untreated exists, the role of each modality in the management of OP must still be determined.

Conclusions

Hunt and Puczyński recommend that the responsibility for diagnosis and case management be assumed by primary care physicians and parents. If OP can be diagnosed in the first few weeks of life and if specific strategies can be implemented to prevent further cranial distortion, “orthotic devices such as soft helmets or rigid head bands should rarely, if ever, be necessary, and surgery for plagiocephaly without synostosis should never be necessary.” This statement represents a testable hypothesis that could be confirmed or rejected quickly by a well-designed case control study.

References


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