

# PEDIATRIC NEWS



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## Travel Medicine for the Pediatrician: The “Travel Meds” Approach

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**I**n this day of jet travel and American prosperity, the globe is truly shrinking— Americans are traveling abroad for business and pleasure in record numbers. Every year, U.S. citizens make 40 million trips overseas, with over half of these involving travel to the ‘developing world’. This year, at least 100,000 travelers will spend more than a month overseas. Despite these numbers and despite the medical problems of the third world, the vast majority of travelers return safely and in good health. Conversely, however, 50,000 Americans annually develop a health problem overseas. Of these, 8,000 will seek medical care, 300 will be hospitalized, 50 will be emergently evacuated, and 1 will die. The provision of competent pre-travel advice by a medical professional can keep this morbidity to a minimum. Although the provision of such advice is not difficult, it does require some attention to detail to ensure that all concerns are adequately addressed. We have developed the “TRAVEL MEDS” approach to pre-travel consultation to assist the clinician in providing comprehensive pre-travel care.

**T**ravel Kits—Travelers, especially those planning lengthy itineraries, as well as those with significant medical needs, should be encouraged to prepare a travel kit. This kit should contain, among other items, those medications prescribed and recommended by the provider below. These might include malarial chemoprophylaxis, diarrhea, jet lag, motion, and altitude sickness medications, insect repellents, and water purification supplies. Additionally, travelers should be specifically counseled to pack adequate amounts of medications necessary for the management of any chronic underlying medical conditions. Moreover, supplies such as insulin syringes should be packed in sufficient quantity to guard against unforeseen travel delays, as replacements may be difficult to find while travelling and may not be sterile. Travelers may also include sunscreen, mosquito netting, first aid supplies, condoms, and other items as appropriate.

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## Visual Function in Children Born Prematurely

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**T**he likelihood of surviving preterm birth has increased dramatically in recent years. Beyond survival, more and more 23 and 24 week infants are thriving, reaching school age, and entering the educational system. One of the many challenges facing such a child has always been visual impairment. Until widespread screening efforts and treatment with cryotherapy and laser became standard of care, many former premies grew up functionally blind with retinal detachments from retinopathy of prematurity ( hence the now antiquated

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**Rabies**—Although animal rabies is relatively common in the United States, enzootics of this disease are fortunately limited to wild animal species. Raccoon, Skunk, Fox, and Bat strains of rabies predominate. The occasional cat, dog, or farm animal that contracts rabies in the United States does so after being bitten by one of these wild animals. Sustained dog-to-dog and cat-to-cat transmission does not occur. This serves to limit the potential for human exposure, as humans rarely seek out contact with skunks, raccoons, and the like. The same cannot be said for many third-world nations, where dog-strain rabies may be prevalent, dramatically increasing the odds of a human coming in contact with a rabid animal. Travelers to select countries, especially those anticipating prolonged visits and those planning a rural itinerary, should be offered pre-exposure rabies prophylaxis. Although physicians providing pre-travel consultation would be wise to check the CDC website ([www.cdc.gov](http://www.cdc.gov)) for up-to-the-minute recommendations, a recent list of countries for whom pre-exposure rabies prophylaxis might be considered would include Brazil, Bolivia, Colombia, Ecuador, El Salvador, Guatemala, India, Mexico, Nepal, Peru, the Philippines, Sri Lanka, Thailand, and Vietnam. Finally, travelers to other locales (including the United States) who plan a spelunking expedition should also be offered prophylaxis. Three rabies vaccines are licensed in the U.S.; all have identical schedules. Pre-exposure prophylaxis consists of 3 doses of any of these, given at time zero, and at 7 and 21-28 days. Travelers actually sustaining a bite still require an additional 2 post-exposure doses, but pre-exposure prophylaxis removes the urgency of obtaining these doses in a third

world nation where they may be unavailable, very expensive, and/or potentially administered using unsafe techniques.

**Arthropods**—While arthropods such as mosquitoes are a nuisance in the United States, they can carry life-threatening diseases in other parts of the world. Malaria, Dengue, Filariasis, Yellow Fever, and other arboviral diseases are transmitted by mosquitoes. Typhus, spotted fevers, Tularemia, and Lyme Disease are transmitted by ticks. Leishmaniasis is carried by the sandfly, Trypanosomiasis by the tsetse fly, and Tularemia by the deerfly. Avoidance of such arthropods is critical for many travelers and begins with knowledge of behavior and habitat. Many mosquitoes, including the Anopheline vectors of malaria, are night-feeders. Limiting outdoor exposure in the evenings goes a long way towards the prevention of malaria. Similarly, the wearing of loose long pants and sleeves, as well as socks and boots, is recommended as a means of avoiding many arthropod bites. Mosquito netting is a useful adjunct in many climes, especially in rural tropical areas, where enclosed rooms may not be available for sleeping. Finally, the travel medicine provider must be familiar with the use of chemical protectants. Permethrin is generally recommended as a treatment for clothing and netting, while DEET (up to 30% concentration) can be applied directly to skin and is quite safe when used appropriately.

**Vaccines**—In many travelers' minds, a pre-travel consultation is synonymous with a vaccination session. While a proper pre-travel visit should include much more, vaccination nevertheless does constitute an important part of the visit. It is perhaps useful to group vaccines into several categories. The first group includes those

vaccines administered to virtually all children, regardless of whether they are traveling. In this sense, the pre-travel visit is yet another opportunity for the Pediatrician to provide routine immunizations. Moreover, many of the diseases prevented by such routine immunization remain prevalent in many parts of the world. Measles is still a major threat in much of Africa and Asia; diphtheria is resurgent in the new nations of the former Soviet Union. Polio, nearing global eradication, nonetheless still occurs in isolated pockets in South Asia. Furthermore, other diseases routinely prevented by immunization in the West may be more problematic for travelers. Adventurous trekkers, for example, may be more likely to sustain a tetanus-prone wound under conditions where proper medical care and wound cleansing may be difficult. Additionally, obtaining a tetanus shot or an immunoglobulin injection in some areas of the third world, where needles may not be sterile, is fraught with hazard. For all of these reasons, the physician providing pre-travel advice should examine the status of a patient's DPT, Polio, MMR, Pneumococcal, Haemophilus, Hepatitis B, and Varicella immunizations.

The second group of vaccines should be offered to the vast majority of foreign travelers, regardless of destination. Hepatitis A and Typhoid are no more prevalent in Canada, Australia, most of Japan, Britain, Scandinavia, and some other parts of Western Europe than they are in the United States. Travelers to virtually any other nation, however, should be considered candidates for immunization against these diseases, especially if they are adventurous eaters or are likely to spend time in rural areas. Of particular note to Pediatricians, there are three Typhoid vaccines and each is approved for different age groups.

A third group of vaccines should be considered on an individual basis, tailored to the traveler's itinerary. Immunization against Japanese Encephalitis should be offered to those planning travel to many areas of East and Southeast Asia, especially if such travel will occur during transmission season (principally summer). Meningococcal vaccine should be offered to travelers to the Sahel region of Africa and to Hajj pilgrims. Yellow Fever vaccine is strongly advised for those journeying to many areas of tropical Africa and South America. Rabies vaccine poses unique considerations and is discussed above.

The fourth group of vaccines includes those necessary to satisfy entry requirements. In the past, Cholera (rarely otherwise recommended, even for those traveling to endemic areas) and Yellow Fever vaccines have been mandatory for entry into certain countries. Saudi Arabia currently requires Meningococcal vaccination for those making the Hajj.

A fifth group of immunizations might include those such as Anthrax and Smallpox, which would be unique to military deployments. Further discussion of these vaccines is beyond the scope of this paper.

**E**nvironmental Concerns—Travel Medicine practitioners should be prepared to counsel patients about the hazards of excessive sun exposure, about the treatment and prevention of motion sickness and jet lag, and about the hazards of fresh and marine water exposure (e.g. when is it not safe to swim?). Travelers to mountainous regions should be taught about altitude sickness, how to prevent it, and how to treat it emergently should it occur. Certified scuba divers are taught about

decompression illness during their training, but travelers to some tropical locales can rent scuba gear and participate in excursions without formal training. Travel medicine practitioners should be familiar with this phenomenon and should counsel travelers appropriately. Finally, patients with underlying respiratory illness should be advised about the very poor air quality in many of the developing world's megacities. Bangkok, Lagos, Mexico City, Beijing, Shanghai, and many other cities are plagued by air pollution that may significantly exacerbate underlying asthma and bronchitis.

**L**ife Among the Natives—As many as 50% of adult travelers experience a sexual encounter with local residents while on an overseas trip. A parallel increase in alcohol consumption while traveling may lower inhibitions regarding such encounters. In some nations, such as Thailand, "sexual holiday" tours may be offered with the expressed purpose of encountering multiple sexual partners and situations. While STDs are a potential problem anywhere, the incidence of certain STDs in some nations is extraordinarily high. The majority of prostitutes in some southern African nations are HIV-infected. The incidence of HIV among commercial sex workers in Thailand is likewise very high and rates are climbing rapidly in India and the former Soviet Union. Hepatitis B is rampant in many third world nations, as is Syphilis. Adolescent travelers should be warned of such conditions and counseled to avoid sex or to use condoms. The United States has formally adopted the "ABC" policy pioneered in Uganda and advocated throughout sub-Saharan Africa: Abstain, Be faithful, or use a Condom. Such advice is particularly appropriate for travelers.

**M**alaria—Malaria remains one of the primary concerns of travelers, and any pre-travel consultation should involve an assessment of the risk of malaria. This very preventable entity remains one of the largest global infectious disease killers. The malarious world can be divided into 3 regions. Reliably chloroquine-sensitive malaria is now limited to areas of Latin America north of the Panama Canal, to Haiti, and to isolated areas of North Africa and the Middle East. In all of these areas, the overall incidence of malaria is many-fold lower than in Africa and Asia, and many persons travelling to these areas require no malaria prophylaxis. When prophylaxis is warranted, chloroquine alone is often sufficient. Travel Medicine providers are advised to check the CDC's (or a proprietary travel service's) website for up-to-the-minute recommendations and guidance. Chloroquine-resistant, but mefloquine-sensitive, malaria predominates in much of the malarious world, including most of sub-Saharan Africa, South and Southeast Asia, and tropical South America. Travelers to these areas should be considered as candidates for mefloquine prophylaxis. In certain areas of Thailand, near the Cambodian and Burmese borders, mefloquine-resistant malaria is common. Adult travelers can be given daily doxycycline, but the prophylaxis of young children going to these areas presents a special problem. Malarone (atovaquone/proguanil) or Chloroquine + Proguanil are possible options in young children who must travel to these remote areas, but such travel should be avoided if possible. Practitioners are advised to consult the CDC website or an infectious disease practitioner for updated advice in those rare circumstances where it cannot be.

**E**mergencies—Emergencies can obviously occur despite the most meticulous pre-travel planning. Preparing ahead for certain possibilities is therefore warranted, especially for those travelers with pre-existing medical conditions. Such patients, as well as any patient planning a lengthy overseas stay, should be advised to check with their health insurance provider regarding overseas coverage, which some policies do not afford. Emergency evacuation to the United States, while a rarity, can be prohibitively expensive when needed. Some health insurers offer supplemental policies covering such eventualities, and travelers with significant underlying problems should be familiar with them. In many nations, physicians require cash payments in advance. Travelers with medical needs may contact the State Department's website ([www.travel.state.gov](http://www.travel.state.gov)) or check with U.S. embassies to obtain a list of overseas medical providers with western credentials. Long-term travelers should also register with the embassy, especially if they are visiting remote locales and/or have special medical needs. Such patients should also be instructed to prepare a summary of their medical conditions, important tests, and prescriptions and carry such a list on their person and in their travel kit. Sufficient prescription medications to allow for travel delays should also be packed, and advance preparations should be made for wheelchairs, oxygen, and other equipment which might be needed.

**D**iarrrhea and Food Safety—Diarrheal illness constitutes one of the most common afflictions of travelers. Although the vast majority of cases are of little long-term consequence, they nonetheless ruin a significant number of vacations. Fortunately,

simple steps can be taken to avoid or ameliorate many cases of traveler's diarrhea.

Most cases of diarrhea acquired during travel are due simply to changes in dietary habits. Nonetheless, a significant minority are infectious, caused by viruses, bacteria, and parasites associated with contaminated food or water. Among the most problematic foods are fresh fruits and vegetables, often grown in third world nations with the aid of "night soil", or human excrement. An old adage among travel medicine providers admonishes the traveler to "wash it, peel it, boil it, or forget it". Some fruits and vegetables (e.g. apples) are readily washed. Bananas, citrus fruit, potatoes, and others can be peeled. Many other vegetables lend themselves to boiling. Tempting foods, which unfortunately are difficult to wash thoroughly, include lettuce, spinach, berries, and the like. Despite their nutritional benefits, these foods are often best avoided in third world settings.

Water supplies in many nations are unsafe by western standards. Short-term tourists can best deal with this by purchasing and drinking only bottled water. A few words of caution are in order here: first, bottles should be inspected for an intact seal. Many an unscrupulous merchant has been known to simply refill empty bottles with tap water; second, travelers should be especially cognizant of ice (usually made with tap water) in beverages and of toothbrushing (which should also be done with bottled water). Longer-term travelers and travelers to remote areas may be unable to purchase or carry adequate supplies of bottled water. Three options are available in this situation: boiling, chemical treatment (with iodine tablets, available from camping and wilderness suppliers), or filtration (with hand-held chemical and/or mechani-

cal filters, which may be ordered from wilderness outfitters).

Many providers will offer travelers prophylactic and/or therapeutic anti-diarrheals. Pre-exposure prophylaxis is possible with Bismuth subsalicylate, but is generally not recommended for children. Instead, parents may be given an antimotility agent such as loperamide and an antibiotic such as TMP-SMX or ciprofloxacin. Such agents can be taken at the onset of clinically significant diarrhea. A three day course is usually adequate; episodes failing to respond promptly to such a course are likely viral. While such measures are safe and effective in the vast majority of cases, patients and parents should be instructed to seek prompt medical attention and avoid self-treatment in cases of bloody diarrhea or in cases associated with significant abdominal pain.

**S**afety—Despite the emphasis place on malaria, diarrhea, and exotic infectious diseases, the number one hazard to foreign travelers is accidents. Road and vehicle conditions, as well as traffic laws, signage, and driver training in many foreign countries are not up to western standards. In Britain, Japan, Australia, and a few other nations, the direction of traffic flow is reversed. Finally, the notion of 'yielding to pedestrians' is absent in certain locales. All of these factors combine to cause very high traffic fatality rates in many nations. Of the few Americans who die while travelling, the majority do so by traffic accident. More recently, terrorism and political unrest have also become significant problems. Travel medicine providers should be familiar with State Department warnings and advisories regarding travel to certain areas. The Shoreland Corporation provides a commercial travel medicine information service. Extensive medical

advice is available to practitioners for a subscription fee. Information aimed at laymen, including updated travel advisories, is available gratis, however, at [www.tripprep.com](http://www.tripprep.com). Providers can print a summary of recommendations and advisories in advance of a travel appointment and can present and review this advice during the visit.

The vast majority of foreign travelers enjoy wonderful adventurous vacations and productive business trips. With a small amount of planning, the travel medicine provider can help ensure that the number of vacations spoiled by illness, accidents, and disease is kept to a minimum. The provision of travel medicine services is not difficult, although a certain amount of planning is necessary to cover the several important topics that should be addressed in the pre-travel consultative visit. Children have certain unique travel and medical needs. By following our "TRAVEL MEDS" approach, the Pediatric Care Provider can insure that those needs are met.



## Cleft Lip and Palate

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**A** cleft lip and cleft palate are congenital defects that affect 1 in 500 to 750 children born. A cleft lip is a separation of the two sides of the lip. The separation often includes the

bones of the upper jaw and/or upper gum. A cleft palate is an opening in the roof of the mouth in which the two sides of the palate did not fuse, or join together, as the unborn baby was developing. Cleft lip and cleft palate can occur on one side (unilateral cleft lip and/or palate), or on both sides (bilateral cleft lip and/or palate). Because the lip and the palate develop separately, it is possible for the child to have a cleft lip, a cleft palate, or both cleft lip and cleft palate.

Clefting is a structural defect that occurs very early in an embryo and is sometimes associated with other syndromes. Syndromal clefts can be linked to abnormal genes but the exact etiology for clefts that are not associated with syndromes is not yet known. Current research indicates non-syndromal clefts may be attributed to genes, environmental factors, or a combination of both. Environmental factors that may be relevant include prenatal exposure to alcohol, tobacco, and/or other drugs.

Speech-language pathologists are part of a multidisciplinary team involved in the assessment and treatment of children who are born with cleft lip and/or palate. Ultimately, the primary goal of the team is to bring the child to the point where they do not differ significantly from their peers in health and education. Secondary goals include providing surgical, dental, medical, and counseling services in order to achieve normal facial appearance, dentition, hearing, speech, and language skills.

Communication skills begin developing at birth. Babies communicate by crying and this eventually develops into cooing and babbling. Babbling is later shaped into words and words are later combined into sentences. When one part of the speech mechanism is congenitally defective, speech does not develop

normally and early speech behavior may be absent. In some cases, children may find ways to compensate with the structures they have. Speech therapy is important in the child's early years to prevent these compensations from becoming habituated.

To further complicate speech and language development, children with cleft palate often have recurrent otitis media (middle ear infections). Frequent occurrence of fluid in the middle ear can influence speech development in several ways. First, the presence of fluid may cause a mild, conductive hearing loss resulting in the child receiving an inconsistent auditory signal. This type of hearing loss may cause children to "miss" sounds of lower intensity (such as s, t, sh, f, th) and parts of speech that are not emphasized in normal intonation (unstressed syllables and final sounds of words). Since children repeat what they hear, this hearing loss may cause the child to begin omitting and distorting certain sounds. In addition, hearing loss may restrict a child's social interaction, resulting in fewer opportunities for the child to learn language and communication skills from their peers.

Intervention for a child with cleft lip and palate begins early in the child's life. A baby born with a cleft should be referred to a craniofacial team for parental counseling and a treatment plan. The parents will have the opportunity to meet the professionals who will follow their child's development until the age of 21. The team often consists of a geneticist, plastic surgeon, dentist, oral surgeon, ENT, audiologist, speech pathologist, dietitian, and a nurse.

Immediately following birth until the child is approximately three months old, intervention focuses on parent education, early identification

of a syndrome if one exists, early identification of hearing loss, and feeding issues. Parents will work with a speech pathologist and a dietitian to develop strategies for feeding their baby. Feeding may involve specialized nipples and bottles, positioning strategies, and non-oral methods in some cases. Breast-feeding is possible with cleft palate but parents should consult professionals who specialize in this area to ensure their child is safe and maintains adequate nutrition.

Surgical intervention begins when the child is approximately three months old. Clefts of the lip can be surgically repaired within a few months after birth. Since the surgery requires a general anesthetic, some surgeons prefer to wait until the child is 10 weeks old, weighs 10 pounds, and has 10 g of hemoglobin.

Typically, clefts of the hard and soft palates are surgically repaired when the child is around 12 months old. Research suggests waiting beyond this age can interfere with the child's ability to develop early, pre-speech behaviors. During the first year of life, children experiment with speech sounds by playing with their articulators (tongue, lips, teeth, hard palate, and soft palate) while babbling. Babies with cleft palate do not have the normal structures or function and babbling may be absent or delayed. Current literature on language development shows that delays in babbling can be linked to later delays in speech and language skills. Children with delays need to be referred to an Early Childhood Intervention program to stimulate speech and language development.

The goal of palatal surgery is to divide the oral cavity from the nasal cavity while creating/preserving an intact velopharyngeal mechanism. The velopharyngeal mechanism is made up of the velum (soft palate), lateral pharyngeal walls, and the

posterior pharyngeal wall. This structure functions as a valve which allows for the decoupling and coupling of the nasal and oral cavities for speech. The velopharyngeal port is the space surrounded by the velum, lateral pharyngeal walls, and posterior pharyngeal wall. In normal anatomy, the velum is in a lowered position for nasal breathing and for the production of nasal speech sounds *m*, *n*, and *ng*. For all other speech sounds, the velum elevates and contacts the lateral and posterior pharyngeal walls to close the velopharyngeal port and to "seal off" the nasal cavity. This movement allows speech sounds to be shunted through the mouth.

Children with cleft palate often have a condition referred to as velopharyngeal insufficiency or inadequacy (VPI). If the velum does not adequately seal off the nasal cavity during speech, speech tends to sound hypernasal. These children often find ways to compensate and they develop distorted productions of speech sounds, especially on sounds that require high intra-oral pressure to produce. Sounds that are most often affected by VPI include *s*, *sh*, *z*, *b*, *p*, *t*, *d*, *k*, and *g*.

VPI can be treated with speech therapy, prosthetic devices, and/or surgical intervention. When VPI is caused by muscle weakness or discoordination, speech therapy is recommended to improve speech skills. Sometimes a child demonstrates adequate function of the velopharyngeal mechanism but may experience a breakdown with fatigue. If this is the case, a dentist may be consulted to customize a prosthetic device known as an obturator or palatal lift. This device looks much like a retainer with a bulb on the posterior end. The bulb functions to elevate the velum and assist the child seal off the nasal cavity during

speech.

If VPI is caused by insufficient structures or function, surgery may be recommended to improve speech. There are several surgical techniques that can be used to correct VPI but the most common one is called a pharyngeal flap. This surgery involves connecting the tissue of the posterior pharyngeal wall to the velum. The goal is to close the gap that exists between the velum and pharyngeal wall in order to decrease air escape into the nasal cavity during speech. This surgery is typically not performed until early school-age. Speech therapy is often necessary after surgery to assist the child re-learn how to produce their sounds without hypernasality or maladaptive compensatory techniques.

As children who were born with clefts reach adolescence, intervention begins to focus on normalizing facial features. Lip revisions and rhinoplasties may be recommended. In addition, psychosocial counseling is important in order to provide the child with strategies to cope with teasing and to improve self-esteem.

Congenital disorders of the speech and hearing mechanisms, such as cleft lip and palate, cause more extensive speech and language disabilities than later acquired disorders. For this reason, it is important for a child with cleft palate to be involved with intervention programs from an early age. Regular assessment of hearing abilities and speech patterns are crucial for normal speech and language development in young children with cleft lip and palate. It is important to remember that functional speech and language development is possible for these children provided that early identification and intervention are made accessible to families who have children with clefting conditions.

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term, retrolental fibroplasia). However, in recent years, the percentage of "high risk premies" (28 weeks, less than 1250 g) who suffer significant visual loss from ROP has dropped to well below 20 % in most studies due to advances in screening and treatment. Therefore, the other previously unrecognized areas of visual dysfunction secondary to prematurity are gaining diagnostic relevance.

The immature visual system in preterm infants, like the neurologic system as a whole, is vulnerable to insult in the perinatal period. The subependymal germinal matrix within the walls of the lateral ventricles, containing precursors of cortical neurons, is a metabolically active area during the first two trimesters. The fragile internal vasculature and watershed zone supporting this area can be affected by hypoxia or hypertensive crises due to impaired autoregulation of cerebral vasculature. The result can be intraventricular hemorrhage and hemorrhage into the parenchyma with subsequent atrophic dilation of the lateral ventricles and thinning and gliosis of white matter. The end stage radiographic lesion is commonly termed periventricular leukomalacia (PVL). If this process takes place adjacent to optic radiations, occipital horns, or trigone, impairment of vision and visual processing can occur. Neuropsychologic studies have shown visuospatial problems in up to 60% of preterm children; this is positively correlated with PVL.(1)

After 34 weeks, the vascular watershed zones lie between the anterior and middle cerebral arteries and middle and posterior cerebral arteries, making the visual cortex rather than the optic radiations more susceptible to injury. One of the

two triple watershed areas in the brain is that serving the parieto-occipital region - the visual association cortex. However, of interest, Lambert and Hoyt have reported worse visual prognoses with optic radiation injury (white matter) than damage to the visual cortex (gray matter). (2)

Most probably associated with the events described above, two groups of abnormalities are found in the ophthalmic exam of former premies - ocular and visual-cognitive. Three areas of interest in the objective ocular exam are refractive error, optic disc appearance, and motility.

Myopia (near-sightedness) is the most common refractive error in those children with ROP, and especially so in those reaching threshold requiring treatment. Those treated with cryotherapy (freezing the retina) are significantly more myopic than those treated with laser. This may be related to the vigorous cicatricial changes of the peripheral retina and ciliary body area after cryotherapy resulting in movement of the lens-iris diaphragm or elongation of the globe. Spectacles are often an early intervention in these cases.

For those that escaped ROP but have PVL, hyperopia (far-sightedness) and astigmatism is more often the case. Associated with this may be an inability to fully accommodate (focus at near), rendering near visual tasks more difficult. Accomodative dysfunction is especially a problem in children who have significant cerebral palsy; a lower threshold exists to prescribe spectacles in this group as well.

Nystagmus and impaired smooth pursuit and saccades are found in many prematurely-born children. Those with primarily cortical visual impairment do not exhibit nystagmus; however those

who are partially-sighted or blind secondary to defects in the anterior visual pathways more commonly have nystagmus. Strabismus associated with PVL can be esotropia or exotropia, is more resistant to attempts at surgical realignment, and can spontaneously resolve or reverse direction. Children with PVL and early onset strabismus rarely experience diplopia or fine stereoacuity. Treatment of strabismus in neurologically challenged children is often not as predictable as with others. The etiology of these entities is not precisely known - lack of clear afferent input to the visual brain or a misguided efferent response to visual information. However, unlike individuals who acquire these disorders later in life, children develop subconscious compensatory mechanisms to best utilize their visual system - head movements, head postures, and eccentric gaze.

Optic disc appearance in former premies ranges from small to normal to normal size with increased cup to disc ratio. Pallor is also reported in association with cerebral palsy and PVL. Brodsky et al made the connection between optic disc hypoplasia and PVL: insults occurring to the optic radiations prior to 28 weeks were more likely to result in small optic nerves, whereas insults occurring after 28 weeks resulted in normal nerves with a larger cup to disc ratio.(3) (5)

Most important, however, in considering long term visual function of pre-term children is the apparent effect of PVL on visual acuity, visual fields, and visuospatial processing. Visual acuity in children with PVL, no matter how good or bad, is characterized by *visual crowding* - the ability to recognize letters or characters of any certain size better when presented singly than in a row. This "dis"ability is more pronounced at

near than at distance. The implications for the process of learning to read are multiple. Visual field defects are common in children with PVL and cerebral palsy, since the optic radiations are primarily affected. The defects are usually hemispheric (occurring in right or left hemifield in both eyes) and are more dense inferiorly. A compounding visual processing problem in these patients is that of *simultanagnosia* - a defect in one's ability to attend to visual stimuli in more than one area of the visual space at a time. This phenomenon is seen also in older patients with strokes in the parieto-occipital visual association areas and presents problems for patients functioning in environments with multiple foci of visual stimulation (busy intersections, active classrooms, playgrounds). Children develop compensatory mechanisms to deal with this but, again, the implications for education are immense.

Other areas of visual processing dysfunction include inability to

recognize familiar faces and orientation difficulties in new environments. Despite oftentimes good visual acuity, when measured on a chart, such children use methods other than central vision - color, touch, and verbal memory- to maneuver through their day. (4)

By the age of four, a child born significantly prematurely has overcome multiple physical obstacles to his survival. As ROP becomes less and less a cause for long term visual handicap, visual cognitive or visual processing issues become more important. For the many former premies entering mainstream education, awareness of these less-recognized but significant visual problems will aid parents and teachers to understand and facilitate the complex compensatory process at work in their child's visual world.

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