

Oculomotor findings in premature children with periventricular leucomalacia at 18 months of corrected age

Maria Marta Galán

*Calle 21-972, La Plata,
CP 1900 Argentina,
Hospital de Niños “Sor Maria Ludovica”
de La Plata, Argentina
E-mail: digio@way.com.ar*

The late visual prognosis in the premature is tied to the sequels of the ischemic phenomena in the first days of life, which determine the necrosis of the white substance in the dorsal and lateral zone to the external angles of the lateral ventricles (1).

Objective: To describe oculomotor alterations in patients with PLM (periventricular leucomalacia).

Materials and Methods: Ocular examination of 32 children with PVLM (oculomotor responses, refraction under cycloplegia and fundus examination by OBI).

Results: The average birth weight was 1560 g. The average gestational age was of 29.5 weeks. Alterations of the optic nerve were found in 14 (8 hypoplasias, 2 increased excavations, 4 atrophies). Nystagmus was present in 6 cases, 5 of them associated with optic nerve pathology and one with blocking position. Ocular deviation in 21 esotropias, 16 exotropias, 3 and 2 deviations conjugated. Six surgical procedures in 5 patients: 3 esotropias, 2 exotropias and 1 nystagmus. Botulin Toxin Type A was applied to 5 patients.

Conclusions: We suggest to continue the follow-up of the premature babies beyond the period of alertness of ROP, to approach the oculomotor disturbances in the context of the general picture, to check the current concepts of the treatment of the deviation.

Key words: periventricular leucomalacia, strabismus, nystagmus

INTRODUCTION

The normatization for the diagnosis and treatment of ROP may diminish the effect of serious forms of disease. Now, the visual prognosis in premature babies is tied also to the sequels of ischemic phenomena in the first days of life, which determine the necrosis of the white substance in the dorsal and lateral zone to the external angles of the lateral ventricles (1). The introduction of systematic cerebral ultrasound in the units of neonatal intensive therapy allowed the identification and follow-up of the injuries *in vivo* and in due real time.

The most sensible method for detecting subclinical lesions is the magnetic resonance, but its value is discussed before the third month of life. Tomography by positron emissions produces functional images revealing the metabolic changes in visointegrative zones between the second and third months. This technique demonstrated that the diminution of the blood flow affects more extensive areas than those exposed by

other diagnostic methods and that all the cerebral hemisphere is affected.

The aim of the present study was to investigate oculomotor alterations in patients with periventricular leucomalacia (PVLM) and to discuss the options of treatment of this ocular deviation.

MATERIALS AND METHODS

This is an observational, retrospective study of 32 children, performed in the Ophthalmology Service of the Hospital of Children Sor Maria Ludovica from La Plata in 2004. All children had been screened for ROP, had undergone cerebral ultrasound examination before the third day of life and then with different frequency according to the findings. The inclusion criteria were ventricular dilatation, no by-pass valve at two months of corrected age, absence of alterations of the refraction and residual retinal injuries. The patients underwent cycloplegic refraction, indirect ophthalmoscopy and orthoptic

examination (cover test, ductions, vergences and nystagmus).

RESULTS

The average birth weight was 1560 g, one case being a surviving Siamese after surgical division. The average gestational age was 29.5 weeks. The ophthalmological examination was normal in 2 patients. We found alterations of the optical nerve in 14, discriminated as follows: 8 hypoplasias, 2 increased excavations, 4 atrophies. Nystagmus appeared in 6 cases, 5 of them being associated with a pathology of optic nerve and 1 with blocking position. Ocular deviation was found in 21, esotropies in 16, exotropies in 3 and conjugated deviations in 2 cases. Three pathologies appeared associated in 2 patients. Strabismus was the alteration that appeared with a higher frequency in isolated form (14 cases). The first pathological data were diagnosed with an average of 6.2 months of corrected age. Six surgical procedures were made in 5 patients: 3 esotropies, 2 exotropies (one primary and the other secondary) and 1 nystagmus. Botulin Toxin Type A was applied as bimuscular injection to 5 patients of 2.5 UI.

DISCUSSION

Many authors found a significant relation between strabismus and injuries of the CNS in premature patients.

Irigoyen et al. (2) studied ocular alterations in babies with less than 1500 g, with PVLM and found that these conditions increased to 15 times the risk of sequels. The alterations of the optic nerve is seen in three forms: hypoplasia or papilla of double contour, increase of the excavation with normal diameter and atrophies. The destruction of the white substance to the periventricular geniculostriate tract causes axonal loss, and by transsynaptic degeneration determines the changes found in the prechiasmatic portion of the optical pathway. According to the stage of cerebral development, a reduction of the number of axones can be present in small papilla (29 weeks) or an increase of the excavation with normal diameter more than 30 weeks (3).

If the fixation is obtained, it is impossible to elicit movements of persecution of the visual stimulus in these babies. In these circumstances the patient uses cephalic movements of the trunk to obtain the pursuit. They are not able to make saccades, and if these appear they are in fortuitous form and not triggered by visual stimuli. Dutton et al. suggest that PVLM causes a deficit of the perception of the movement, due to the damage of the arcuate fibers that connect the striated cortex with the zones of the motor command of the ocular movements. This author denominates ocular cerebral palsy to the association of oculomotor and sensorial alterations that appear in leucomalacia. Jakobson and Ygge (6) add nystagmus to the typical features. The defects of field can be suspected by the location of the injuries and have

been confirmed by numerous authors who studied the answers in greater children. For Cioni (7), the developmental delay under one year is bound to the deficit of the visual functions mainly in the cognitive aspect. By these mechanisms or with an intervention of others still unknown, in the following stage ocular deviations can appear. In our patients, esotropia predominated over the exodeviations. Strabismus is a more frequent alteration after cerebral palsy in the group of Irigoyen. The deviation related to the side of the injured hemisphere has been present in the cases in which the ventricular dilatation was asymmetric. Surgery for strabismus correction was systematically delayed in the patients with neurological alterations. Illanes (10) thinks that surgery does not have to be indicated until the stability of the angle is verified. Charles and Moore (11), however, maintain that it should not be delayed, although they make smaller amounts for the same angle of deviation, obtaining 73% of satisfactory alignment in a group of premature children with cerebral palsy. The number of patients operated on in our study and the little time of follow-up are insufficient to adhere to any of the two opinions.

CONCLUSIONS

We suggest:

1. To continue the follow-up of premature babies beyond the period of alertness for ROP.
2. To evaluate the plasticity of the visual pathway after an early damage of tissues and the influence it can exercise on the cerebral reorganization.
3. To approach the oculomotor troubles in the context of the general picture.
4. To study methodically the ocular movements.
5. To check the current concepts of treatment of this deviation.

Received 6 June 2006

Accepted 31 July 2006

References

1. Fazzi E, Lanzi G. Neurodevelopmental outcome in very-low-birth-weight infants with or without periventricular hemorrhage and / or leucomalacia. *Acta Paediatr* 1992; 81: 808–11.
2. Chasco Irigoyen C R y col. Leucomalacia periventricular e hiperecogenicidad persistente: Relación entre hallazgos ecográficos y secuelas. *Anales españoles de Pediatría* 1997; (46)5: 471–6.
3. Casteels, I, Demaerel P. Cortical visual impairment following perinatal hypoxia: clinicoradiological correlation using magnetic resonance imaging. *Journal of Pediatric Ophthalmology and Strabismus* 1997; 34: 297–305.
4. Jacobson, L, Hellstrom A. Large cups in normal sized optic discs. *Arch. Ophthalmol* 1997; (115): 1263–9.
5. Phillips J, Stephens P. Ocular morbidity in very low-birth-weight infants with intraventricular hemorrhage. *Am Journal of Ophthalmology* 1997; (122)2: 218–23.

6. Jacobson L, Ygge J. Nystagmus in periventricular leucomalacia. *Br. Journal Ophthalmol* 1999; 82: 1026–32.
7. Cioni G, Bertucelli B. Correlation between visual function, neurodevelopment outcome, and magnetic resonance imaging findings in infants with periventricular leucomalacia. *Arch Dis Child Fetal Neonatal* 2000; 82: 34–46.
8. Jacobson L, Ygge J. Oculomotor findings in preterm children with periventricular leucomalacia. *Acta Ophthalmologica Escandinava* (letters to editor), 1996.
9. Jacobson L, Ek U. Visual impairment in preterm infants children with periventricular leucomalacia. Visual cognitive and neuropsychiatric characteristics related to cerebral imaging. *Development Medicine and Child Neurol* 1996;11.
10. Illanes A E. Estrabismo y parálisis cerebral. XII Congreso del CLADE 1996 Buenos Aires, Mayo de 1996.
11. Charles S Moore T. Results of early surgery for infantile esotropias in normal and neurologically impaired children. *Eye* 1996; 603–6.
12. Scott A. Tratamiento del estrabismo con toxina botulinica. Consejo Latinoamericano de Estrabismo 1999; 375.