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ASSOCIATION BETWEEN DYNAMIC ASYMMETRY OF THE NEWBORN'S HEAD AND INTRAUTERINE FACTORS

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ABSTRACT - A non-comparable, individual, observational and contemporary cross-sectional study in newborns was made to determine the dynamic lateralization in the head turning after release from the midline and its relationship with obstetric variables. From October to December of 2005, 320 newborns were admitted to the Adjacent Lodgings of the University Hospital of Santa Maria. From those, 89 were selected for assessment of the vestibular function since they have had previously fetal static control through ultrasound. Our results show that the right-sided head lateralization was significantly greater than the left-sided. The predominancy of the lateralization towards the right side also occurred in cephalic presentations and left-sided back, however these were not significant. Results corroborate with the existing literature and suggest an association between fetal static and vestibular function.

KEY WORDS: newborn, laterality, fetal position, vestibular system.

Associação entre a assimetria dinâmica da cabeça do recém-nascido e fatores intra-uterinos

RESUMO - Com o objetivo determinar a lateralização dinâmica na prova da queda da cabeça e sua associação com variáveis obstétricas, foi realizado um estudo transversal no recém-nascido, não comparado, individual, observacional e contemporâneo. No período de outubro a dezembro de 2005, 320 recém-nascidos foram admitidos no Alojamento Conjunto do Hospital Universitário de Santa Maria, e destes 89 foram selecionados para avaliação da função vestibular, por terem feito controle da estática fetal através do ultrasom. Nossos resultados mostram que a lateralização da cabeça para a direita foi significativamente maior do que para esquerda. Também este predomínio da lateralização para a direita ocorreu nas apresentações cefálicas e com o dorso para esquerda, no entanto estes não foram significativos. Nossos resultados corroboram com a literatura existente, e sugerem uma associação entre a estática fetal e a função vestibular.

PALAVRAS-CHAVE: recém-nascido, lateralidade, posição fetal, sistema vestibular.

During his earliest days of life, the movements accomplished by the newborn are mainly reflexes either to the external environment or to inner sensations. Thus, according to his environment, the newborn's nervous system is able to express the necessary reactions for his adaptation and subsistence. Reflex activities, which are transmitted by heredity, vary according to the species and oscillate among their peculiar circumstances of life[1,2]. This set of movements accomplished since the first living hours is described by a series of functional asymmetries, already having its lateralization preferences[3,4]. This has been observed since the forties, including head turning lateralizations[5].

Hepper et al.[6] observed that this lateralization starts its development in the prenatal stage, specifically from ten weeks gestational age. Hooker, in 1942[7], ratifies that the vestibular apparatus is already formed in the human embryo around the second month of pregnancy. The younger the child is the narrower the functional cohesion between the vestibular apparatus and proprioception will be[8]. The majority of human populations shows a preference for accomplishing things with the right side of the body, whether it is to write, to kick a ball or to hear a sound[9]. In spite of this fact, there are further doubts about the origin of this side preference, where various theories arise, from hemi-

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spherical dominance, testosterone influence to the influence of the pelvic or cephalic presentation at the moment of birth[1,3,10-12].

This present study aimed to determine the dynamic lateralization in the head turning after release from the midline and its association with gender, fetal static and the type of delivery.

METHOD

From October to December of 2005, a cross-sectional study was made with newborn infants admitted to the Adjacent Lodgings of the University Hospital of Santa Maria. From the 320 admitted patients in the unit, a group of 89 was selected for assessment of the vestibular function through head turning after release from the midline. The group was selected from the whole totality of newborns in the unit at the moment of the testing. Infants fulfilling the selection criteria were full-term healthy newborns with an ultrasound from the last thirty days of pregnancy (to verify fetal statics), fifth minute Apgar score of eight or more and weighting 2500g or more.

The present study was approved by the Ethics Committee of the Health Sciences Center of the Federal University of Santa Maria (UFSM). The procedures were explained to the parents and permission was obtained from them for their infant to participate.

Ultrasound exams to evaluate fetal static were obtained by the researcher (R.C.M) using an ATL(1500) through different pregnancy stages, being at least one, within thirty days prior to birth.

Every newborn was submitted to a physical and neurological evaluation, including the vestibular function assessment: head turning after release from the midline, head rotation, asymmetric tonic neck reflex (ATNR), lateral rotatory movement and doll's eye maneuver[2,13].

During the head turning test, the newborn remained lying supine slightly seated with his head sustained by the researcher's hand. When the cephalic holder was unlocked, the head turning was observed for up to five seconds, in order to verify the existence of head lateralization. This procedure was carried out three times (Fig 1A-B). It was considered a head turning preference when the neck turned only to one of the sides. If the neck did not turn three times to the same side, a fourth procedure was carried out. If the newborn turned his head twice to each side, it was classified as equivalent. When the neck and head remained in the midline position during the three procedures, the newborn was classified as neutral.

The entire procedure took place in an examination room of the Adjacent Lodgings of the Hospital. The newborns were naked during the trials and the ambient temperature was 25-30°C. Apart from crying[14], every neurobehavioral status was considered. Tests were run by the same researcher (C.R.B) and to help control standards, twice a week tests were also conducted by a second researcher (F.S.P). In order to confirm the obtained data every test was recorded with a video camera to be later on, analyzed.

From the recordings of the variables, a database was assembled using SPSS (version 11.5) statistics software, where all the analyses were performed.

Descriptive frequency analysis was used for categorical variables; for quantitative variables, mean and standard deviation were calculated. Chi-square analysis and the Statistic F were used to compare head turning, gender and fetal static (presentation and back), being 5% the chosen significance level.

RESULTS

From the totality of newborns, 33 (37.1%) were male. Regarding the type of delivery, 31.5% was vaginal and 68.5% was caesarean. Gestational average age was 39 weeks[15], average weight was 3.163g ± SD 469g; average size was 48cm ± SD 2.46cm and average of the cephalic perimeter was 34cm ± SD 1.52cm. The average lifetime of the newborns, when tested, was 33 hours ± SD 16h. From all infants, 87.6% were classified as suitable for their gestational age and 12.4 % were classified as big[16].

Regarding last ultrasound's fetal static, data are presented in Table 1. Right-sided head dynamic lateralization was predominant in 56 (62.9%) of the newborns (P=0.001) as shown in Table 2.

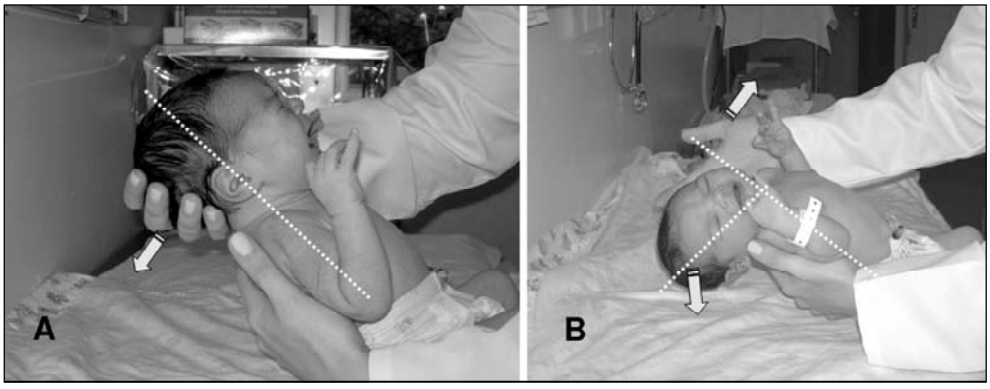

Fig 1 A-B. Head turning after release from the midline, before and after.

Table 1. Fetal static in the last ultrasound (n=89).

	n	%
Situation		
Longitudinal	89	100
Transverse	0	0
Presentation		
Cephalic	80	89.9
Pelvic	9	10.1
Back		
Right	39	43.9
Left	48	53.9
Other	2	2.2

Table 2. Dynamic head lateralization (n=89).

Head turning after release from midline	n	%
Right	56	62.9
Left	18	20.2
Neutral	9	10.1
Both	6	6.7
Total	89	100

p=0.001

Table 3. Association between gender and dynamic head lateralization (n=89).

Gender	Head lateralization			
	Right		Other	
	n	%	n	%
Male	23	69.7	10	30.3
Female	33	58.9	23	41.1
Total	56	62.9	33	37.1

p=0.3

Table 4. Association between fetal presentation in the last ultrasound and dynamic head lateralization (n=89).

Presentation	Head lateralization			
	Right		Other	
	n	%	n	%
Cephalic	51	63.8	29	36.3
Pelvic	5	55.6	4	44.4
Total	56	62.9	33	37.1

p=0.63

Table 5. Association between fetal back positioning in the last ultrasound and dynamic head lateralization (n=89).

Back	Head lateralization			
	Right		Other	
	n	%	n	%
Right	25	64.1	14	35.9
Left	31	62.0	19	38.0
Total	56	62.9	33	37.1

p=0.84

Tables 3, 4 and 5 present the association with gender (p=0.3), presentation (p=0.63) and back (p=0.84).

As for the presentation at the moment of birth, was observed that only one newborn switched from pelvic to cephalic position. When this incident was analyzed, it was verified that there was no change from the last ultrasound.

Regarding dorsal position in the last ultrasound, newborns with right-sided intrauterine placement showed a rightward predominance of 28% in the head turning and 15.7% in the other tested positions. From those with a left-sided intrauterine positioning, the rightward predominance was 34.8% in the head turning and 21.3% in the remaining tested positions.

DISCUSSION

The association between head turning after release from midline and the other variables demonstrates a predominancy of rightward lateralization. As for gender, it was observed that both, male and female, presented a right-sided preference. Same occurrence could be perceived regarding types of delivery, since both of them presented a rightward bias, however the difference of type has not been significative.

The findings agree with Rönnqvist et al.[17] when studying head lateralization in newborns through Moro response, discovered a right-sided head preference in the ratio of 2 (right): 1 (left). They also found no evidences of association between type of delivery and head turning lateralization.

Vestibular predominance can be defined by intrauterine fetal asymmetry, during the last trimester of pregnancy. The most preponderant maternal factor is the uterine anatomy that can place itself in a rightward oblique axis, helping the fetus head positioning towards the right side, while his body remains on the left side. There is also a better fixation of the placenta in the right side of the uterus. Another maternal asymmetry is the difference in the anatomy of the muscular fibers in the uterus, which certainly interfere with uterine contractions[3].

Dorsal placement in the last ultrasound was 56.1% towards the left side and head turning was 34.8% rightward. Sustaining that this position makes the left vestibule suffer greater inertial stimulation, having advantage over the right one, which is deficient in the head turning. In spite of a higher leftward dorsal positioning occurrence, which provides a greater right-sided lateralization, there was no significant difference[3]. According to the neurobehavioral status it was observed that a deepening in the sleep from stage 2 to 1 reduces the rightward head lateralization and makes it more symmetric. This finding was also perceived by Domellöf[4] as well as a variation of intensity in the motor responses, in conformity with the neurobehavioral status.

Rightward lateralization was preponderant. This asymmetry was also observed during newborn's static inspection, where 55% presented a rightward rotated neck. Both situations showed rightward male bias, yet with no significance. However, male gender is usually more asymmetric in relation to tonus, asymmetric tonic neck reflex and grasp reflex[5]. Regarding gender asymmetries, Tan[11] agreed with Previc[3] on the influence of testosterone and added that this influence varies according to the intrauterine positioning. Spreen[1] mentioned that asymmetry due to testosterone do not apply only to the head lateralization, but also to the inherent functions of the left hemisphere, which is less developed in males, causing speech and learning disorders and also some autoimmune dysfunctions.

Regarding the type of delivery, no difference was found in head dynamic lateralization, what coincides with the literature, although Hopkins and Rönnqvist[10] have found opposing data to that finding. Although there was no association between fetal presentation and dynamic head lateralization, pelvic presentations also had greater rightward lateralization. If there were more pelvic deliveries, probably the lateralization bias would have been leftward, as according to indicated in literature. Fong et al.[12] narrated a preference in the cephalic lateralization when the presentation is cephalic, whereas in pelvic presentation there is no lateralization pattern.

The static and dynamic head lateralization was preponderantly right-sided. There was male rightward lateralization predominance over the female gender, however not significant. The same predominance was observed with fetal static (presentation and back) and type of delivery.

REFERENCES

1. Spreen O, Risser A H, Edgell D. Newborn infant assessment. In Developmental neuropychology. New York: Oxford University Press, 1995:113-138.
2. Pedroso FS, Rotta NT. Neurological examination in the healthy term newborn. Arq Neuropsiquiatr 2003;61:165-169.
3. Previc FH. A general theory concerning the prenatal origins of cerebral lateralization in humans. Psychol Rev 1991;98:299-334.
4. Domellof E, Hopkins B, Ronnqvist L.Upper and lower body functional asymmetries in the newborn: do they have the same lateral biases? Dev Psychobiol 2005;46:133-140.
5. Gesell A, Ames, LB. The development of handedness. J Genet Psychol 1947; 70:155-175.
6. Hepper PG, McCartney GR, Shannon EA. Lateralised behavior in first trimester human fetuses. Neuropsychologia 1998;36: 531-534.
7. Hooker D. Fetal reflexes and instinctual processes. Psychosom Med 1942;4:199-205.
8. Schrager O L, Cowee L C. Exploración vestibular en el niño pequeño. Fonoaudiológica 1968; 14:51-70.
9. Searleman A, Porac C. Lateral preference patterns as possible correlates of successfully switched left hand writing: data and a theory. Laterality 2001;6:303-314.
10. Hopkins B, Rönnqvist L. Motor asymmetries in the human newborn are state dependent, but independent of position in space. Exp Brain Res 2000;134:378-384.
11. Tan U, Zor N. Relation of serum free-testosterone level to grasp-reflex strength in human neonates with right-ear and left-ear facing out in-utero positions. Int J Neurosci 1994:75:9-18.
12. Fong BF, Savelsbergh GJ, van Geijn HP, de Vries JI. Does intra-uterine environment influence fetal head-position preference? A comparison between breech and cephalic presentation. Early Hum Dev 2005;81:507-517.
13. Prechtl HFR. The neurological examination of the full-term newborn infant. In: Clinics in developmental medicine. 2.Ed. London: William Heinemann, 1977:1-68.
14. Precthl HFR. The behavioural states of newborn infant: a review. Brain Dev 1974;76:185-212.
15. Capurro H, Konichezky S, Fonseca D, Caldeyro-Barcia R. A simplified method for diagnosis of gestacional age in the newborn infant. J Pediatr 1978;93:120-122.
16. Battaglia FC, Lubchenco LO. A pratical classification of newborn infants by weight and gestacional age. J Pediatr 1967;71:159-163.
17. Rönnqvist L,Hopkins B, van Emmerik R, de Groot L. Lateral biases in head turning and the Moro response in the human newborn: are they both vestibular in origin? Dev Psychobiol 1998;33:339-349.