

# PREVALENCE OF NEUROLOGICAL INJURIES DIAGNOSED BY TRANSFONTANELLE ULTRASONOGRAPHY IN TERM NEWBORN

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## ABSTRACT

**INTRODUCTION:** Ultrasonography (USG) is the most widely used neuroimaging procedure, as it provides information on perinatal brain injury to predict long-term results. Transfontanellar USG (TFUS) is a routine examination for those with lower gestational age than 34 weeks and there are many studies that talk about the prevalence of injuries for this group and few studies related to findings in term newborns (NB). Studying the findings of the TFUS are essential in the health care of premature babies, aiming at better prognosis.

**OBJECTIVE:** To measure the main findings in TFUS in term newborns.

**METHODS:** Descriptive quantitative and retrospective cross-sectional study, developed in a public maternity of reference in Goiânia-GO.

**RESULTS:** All NBs admitted to the intensive care unit (ICU) from January to December 2019 were analyzed in a total of 265, 50 of which were considered terms in relation to gestational age and who were indicated to perform the USFT (excluding six cases due to incomplete forms) totaling a final total 44 patients. Maternal profile was women between 18 and 30 years old (62%), primiparous (50%), less than seven prenatal consultations (62%), cesarean section (62%) with risk factors associated with preeclampsia and urinary tract infections (43%). Profile of the newborns is female (75%), 38 weeks (38%), apgar score 1° minute an seven (65%), apgar score 5° more than eight (75%), appropriate to gestational age (62%) and more than 2,501 grams (62%). 25% of deaths were registered in the group of patients with abnormalities, 100% of whom were diagnosed with leukomalacia.

**CONCLUSION:** 44 tests were performed, 82% of which were normal and 18% abnormal. The main alteration found in this group was leukomalacia with 50%. Maternal profile was women between 18 and 30 years old, primiparous who had less than seven prenatal consultations and who had deliveries by cesarean section with risk factors associated with preeclampsia and urinary tract infections. The profile of the newborns is female, born at 38 weeks, with an Apgar score less than seven, an Apgar score greater than eight, with a weight appropriate to gestational age with babies over 2,501 grams.

**KEYWORDS:** LESIONS, TRANSFONTANELLE, ULTRASONOGRAPHY, DIAGNOSIS.

## INTRODUCTION

Since the late 1970s, ultrasonography (USG) has been the most widely used neuroimaging procedure, as it provides information on perinatal brain injury to predict long-term results<sup>1</sup>. Favorable qualities of the ultrasonography that make it almost indispensable for routine newborn care include easy access, low cost, portability, lack of ionizing radiation and no need of sedation nor anesthesia<sup>2</sup>.

It is very useful in many clinical situations, making it possible to select which patients will benefit from other techniques that are more invasive or more expensive, or that require sedation, such as the magnetic resonance imaging (MRI). The disadvantages of the technique are that it depends on the operator and that an appropriate acoustic win-

dow is required. It also has limitations in the study of obstetric trauma, in the assessment of complex malformations and in the assessment of damage to white matter<sup>3</sup>.

Cranial ultrasound screening is suggested in the first 4-7 days of life with a repetition of the cranial ultrasound within 10-14 days. When used this way, cranial ultrasound presents 100% sensitivity for the detection of severe intraventricular hemorrhage injuries and severe white matter injury. If the ultrasound examination is normal, a follow-up examination at the corrected gestational age of 36 to 40 weeks (equivalent term) is suggested to track evidence of more serious lesions in white matter<sup>4</sup>.

It is known that pregnancy is measured from the first day of the last normal menstrual period and can be counted

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by complete gestational weeks, where pregnancies with less than 37 complete weeks are considered preterm and less than 42 complete weeks are considered term<sup>5</sup>.

Transfontanelar US (TFUS) is a routine exam for those with gestational age less than 34 weeks and there are many studies that talk about the prevalence of injuries for this group and few studies related to findings in term newborns. To study the findings of TFUS is essential for the health care of premature babies, thus aiming for better prognosis.

## METHODS

Cross-sectional quantitative and retrospective study, carried out in a public maternity of reference in Goiânia-GO. The hospital is part of the Municipal Public Health System of Goiânia with ICU and neonatal intensive unit care (NIUC) exclusively for users of the Unified Health System (SUS).

The research was carried out from January to December 2019, including all newborns who passed through the NICU in the established period (excluding newborns in which the medical records were incomplete and did not have enough data for analysis).

For data collection it was developed an instrument for secondary data including maternal variables: maternal age, number of children, number of prenatal consultations, maternal risk factors and type of child-birth. The neonatal variables were the Apgar score in the first and fifth minutes of life, gestational age, sex and weight and the TFUS: type of lesion presented. The collected items were inserted in an electronic spreadsheet (Excel, Microsoft Corporation, USA) and the EpiInfo 2002 system (Centers for Disease Control and Prevention, USA) was used for the analysis of tables and graphs.

This research project was based on Resolution N0. 466/2012 ensuring the rights of those involved and approved by the Ethics Committee appointed by Plataforma Brasil.

## RESULTS

All NBs admitted to the ICU from January to December 2019 were analyzed representing a total of 265, 50 of which were considered terms in relation to gestational age and who were indicated to undergo TFUS (excluding six patients who were incomplete), totaling 44 medical records.

USTF	N	%
Normal	36	82
Changed	8	18

Source: Research data, 2019.

Table 1 - Distribution of the results of the TFUS performed in term newborns at HMDI, Goiânia (GO), Brazil, 2020.

	Number of patients (N=8)	
	N	%
<b>MATERNAL AGE</b>		
≤ 17	2	25
18 – 30	5	62
≥31	1	13
<b>NUMBER OF PREGNANCES</b>		
1	4	50
2-3	3	37
≥ 4	1	13
<b>PRENATAL CONSULTATIONS</b>		
< 7	5	62
≥ 8	3	38
<b>TYPE OF CHILDBIRTH</b>		
Cesarean	5	62
Normal	3	38
<b>MAIN RISK FACTORS</b>		
DHEG	3	43
Urinary Tract Infection	3	43
Diabetes	1	14

Source: Research data, 2019.

Table 2 - Distribution of maternal characteristics of NBs in the NICU who underwent TFUS at the HMDI, Goiânia (GO), Brazil, 2020.

	Number of patients (N=8)	
	N	%
<b>GENDER</b>		
Female	6	75
Male	2	25
<b>GESTATIONAL AGE</b>		
37 weeks	1	12
38 weeks	3	38
39 weeks	2	25
40 weeks	2	25
<b>APGAR 1°</b>		
< 7	5	62
≥ 8	3	38
<b>APGAR 5°</b>		
< 7	2	25
≥ 8	6	75
<b>WEIGHT FOR GESTATIONAL AGE</b>		
AIG	5	62
GIG	-	0
PIG	3	38
<b>WEIGHT RANGE ( IN GRAMS)</b>		
<2.500	3	38
≥2.501	5	62

Fonte: Dados da pesquisa, 2019.

Table 3 - Distribution of the characteristics of NBs in the NICU who underwent TFUS at the HMDI, Goiânia (GO), Brazil, 2020.

Alterações encontradas	N	%
Leucomalácia	4	50
Calcificações Talâmicas	3	38
Hemorragias	1	12

Source: Research data, 2019.

Table 4 - Distribution of the results of the altered TFUS performed in Term NB at HMDI, Goiânia (GO), Brazil, 2020.

25% of deaths were registered in the group of patients with alterations, 100% of whom were diagnosed with leukomalacia.

## DISCUSSION

Ultrasonography is a non-invasive diagnostic technique and has been used to detect intracranial lesions in neonates for a long time. This study evaluated 44 TFUS exams performed on term NBs, 82% of whom were within normal limits and 18% abnormal.

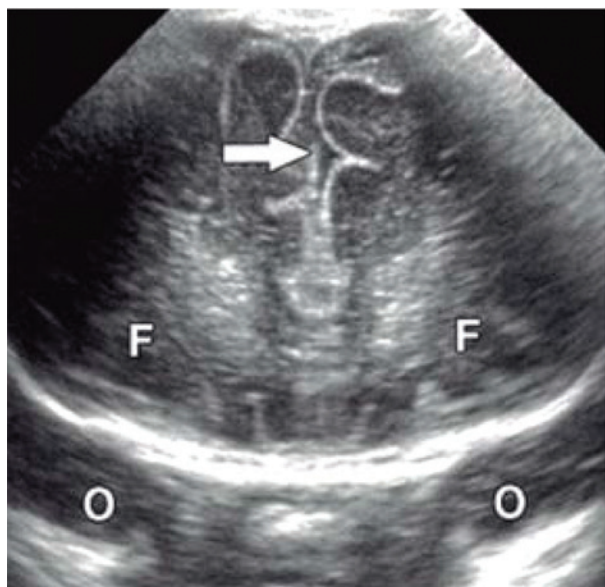


Figure 1 - TFUS image in coronal section of the frontal lobe<sup>5</sup>.

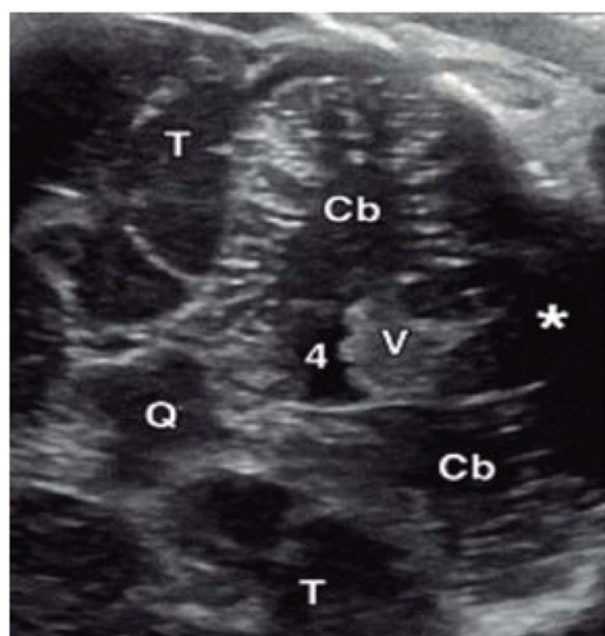


Figure 2 - TFUS image showing cerebellar hemispheres (Cb), fourth ventricle (4), cisterna magna (asterisk), quadrigeminal plaque (Q), vermis (V) and temporal lobes (T)<sup>5</sup>.

The main alteration found in this group was leukomalacia with 50%. Hsu et al.,<sup>6</sup> evaluated 3186 term neonates between September 2004 and August 2009 and found 93.6% within the normal range, 6.3% with minor alterations and 0.1% with major alterations.

Santos e Prado<sup>7</sup> researched 52 medical records of NBs. As for the ultrasound diagnosis, 63% of the NBs presented a normal result. Abnormal TFUS (37%) were classified into five types of injuries: intracranial hemorrhage (ICH) and peri-intraventricular hemorrhage (PIVH) making up for 9% of those affected, hypoxic-ischemic encephalopathy (HIE, including periventricular leukomalacia) 17%, dilation ventricular (DV) 9% and cerebral malformations affecting 2% of the population.

The maternal profile was of women between 18 and 30 years old, primiparous who had less than seven prenatal consultations and who had deliveries by cesarean section with risk factors associated with preeclampsia and urinary tract infections. The profile of the NBs is female, born at 38 weeks, with Apgar 1st minute less than seven, Apgar 5th minute greater than eight, with appropriate weight for the gestational age and above 2,500 grams. Baumert et al.,<sup>8</sup> analyzed 2675 term newborns between the years 2003-2005. Periventricular / intraventricular hemorrhage were diagnosed in 392 neonates (14.65%). The average gestational age of the group was  $39.11 \pm 1.26$  weeks and ranged from 37 to 43 weeks and a higher prevalence of males and low birth weight was found, disagreeing with our findings.

Haataja et al.,<sup>9</sup> analyzed 103 babies and revealed that accidental abnormalities on the ultrasound in term newborns, in particular intraventricular hemorrhage, though common, seem to have a good prognosis and the doctor should take a closer look at those with white matter injuries. White matter damage is a major risk factor for cerebral palsy, and the main presentation is periventricular leukomalacia. Although the etiology of white matter damage in preterm infants is largely related to circulatory changes, the etiology in term babies is less well understood<sup>10</sup>.

Hsu et al.,<sup>6</sup> the cranial ultrasound screening test can play a role in the early diagnosis of intracranial anomalies in term newborns. Hayward<sup>11</sup> suggests that ultrasound should be the initial neuroradiological investigation in this age group and that all term babies in a special care unit should be routinely examined.

Few studies have been found that analyze transfontanelle ultrasonography in term NBs. Jensen and Holmer<sup>12</sup> the fact that apparently healthy term newborns are not screened by head images is considered the missing link between the insult that escapes diagnosis and the neuropsychomotor development delay.

## CONCLUSION

44 exams were performed among which 82% were normal and 18% abnormal; the main alteration found in this group was leukomalacia with 50%. The maternal profile was

of women between 18 and 30 years old, primiparous who had less than 7 prenatal consultations and who had deliveries by cesarean section with risk factors associated with preeclampsia and urinary tract infections. The profile of the newborns is female, born at 38 weeks, with Apgar 1st minute less than seven, Apgar 5th minute greater than eight, with appropriate weight for the gestational age and above 2,500 grams.

## REFERENCES:

1. Diwakar RK & Khurana O. Cranial sonography in preterm infants with short review of literature. *J Pediatr Neurosci.*, 2018; 13(2): 141-49.
2. Gupta P, Sodhi KS, Saxena AK, Khandelwal N, Singhi P. Neonatal cranial sonography: A concise review for clinicians. *J Pediatr Neurosci.*, 2016; 11(1): 7-13.
3. Llorens-Salvador R & Moreno-Flores A. The ABCs of transfontanelar ultrasound and more. *Radiologia*, 2016; 58(2): 129-41.
4. Riedesel EL. Neonatal cranial ultrasound: advanced techniques and image interpretation. *J Pediatr Neurol.*, 2018; 16(1): 106-24.
5. Lowe LH & Bailey Z. State-of-the-art cranial sonography: Part 1, Modern techniques and image interpretation. *American Journal of Roentgenology*, 2011; 196(1): 1028-33.
6. Hsu CL, Lee KL, Jeng MJ et al. Cranial ultrasonographic findings in healthy full-term neonates: A retrospective review. *Journal of the Chinese Medical Association*, 2012; 75(8): 389-95.
7. Santos DSS & Prado MSG. Ocorrência de lesões neurológicas em recém-nascidos diagnosticadas por ultrassonografia transfontanela. *Rev Enferm UFPE* 2017; 11(10): 4081-8.
8. Baumentt M, G Brozek, M Paprotny, Z Walencka, H Sodowska, W Cnota, K Sodowski. Epidemiology of peri/intraventricular haemorrhage in newborns at term. *Journal Of Physiology And Pharmacology*, 2008; 59(4): 67-75.
9. Haataja L, Mercuri E, Cowan F, Dubowitz L. Cranial ultrasound abnormalities in full term infants in a postnatal ward: outcome at 12 and 18 months. *Arch Dis Child Fetal Neonatal.*, 2000; 82(1): 128-33.
10. Berger S, Bender S, Sefkow S, Klingmüller V, Künzel W, Jensen A. Peri / intraventricular haemorrhage: a cranial ultrasound study on 5286 neonates. *Eur J Obst Gyn Reprod Biol*, 1997; 75(2): 191-203.
11. Hayward C. Transfontanelar ultrasound of term infants. *Clin Radiol.*, 1994; 35(5): 337-41.
12. Jensen LA & Holmer B. White matter damage in 4,725 term-born infants is determined by head circumference at birth: the missing. *Obst Gynecol Intern.*, 2018; 1(1).