

MAIN FINDINGS IN TRANSFONTANELLAR ULTRASOUND IN PREMATURE NEWBORNS

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ABSTRACT

INTRODUCTION: Transfontanelar ultrasonography (TFUS) is an important tool for cranial pathologies of newborns (NBs), which allows the design and evolutionary control of injuries. Knowing the main findings and correlating them with gestational age and birth weight is important to outline the best approaches.

OBJECTIVE: Identify the main lesions found in TFUS of premature newborns in the ICU.

METHODS: Cross-sectional quantitative and retrospective study, developed in an intensive care unit (ICU) in Goiânia-GO.

RESULTS: 150 records of NBs who underwent transfontanelar ultrasonography (TFUS) admitted to the ICU were analyzed, with 36 NBs (24%) showing changes. The maternal profile was of young women, without risk factors, multiparous, with seven prenatal consultations, with vaginal delivery. Urinary tract infection was the most prevalent (41%). For NBs, there is a predominance of males (58%), extremely premature infants with gestational age <27 weeks occurred in 19 fetuses (51%), first-minute Apgar less than 7 (72%) and fifth-minute Apgar greater than 8 (78%). The majority (97%) had adequate weight for gestational age, below 2,500g though. The main alteration found was hemorrhage (91%) and grade II the most prevalent (43%). The average length of stay in the unit was 50 days and the death rate in this group was 11 newborns (31%) and the main TFUS change recorded in the death group was grade III hemorrhage.

CONCLUSION: 150 exams were performed, 76% of which were normal and 24% abnormal, the main alteration found was hemorrhage 91%, with grade II being the most prevalent with 43%. In the group that died, the main change in the TFUS was grade III hemorrhage.

KEYWORDS: LESIONS, TRANSFONTANELAR, ULTRASONOGRAPHY, PRETERM.

INTRODUCTION

In recent years, the survival of premature low birth weight newborns has increased due to the understanding of brain pathologies¹. Premature birth is the one that occurs before 37 weeks of gestation. A low birth weight newborn is one who weighs less than 2,500 g² at birth.

There are some possible tests for the diagnosis of neurological diseases in the neonatal period, such as: transfontanelar ultrasonography (TFUS), computed tomography (CT) and nuclear magnetic resonance (NMR)³.

It is known that transfontanelar ultrasonography (TFUS) is an important tool for the cranial pathologies of NBs, which allows the design and evolutionary control of injuries. Knowing the main findings and correlating them with gestational age and birth weight are important to outline the best approaches.

TFUS consists of a non-invasive diagnostic method that obtains images by positioning the ultrasound probe on the neonate's anterior fontanelle, thus being able to assess the brain parenchyma, ventricles and vascular structures, in addition to allowing visualization of morphological changes such as intracranial hemorrhages³. The main changes in these US findings are: intraventricular hemorrhage (IVH), periventricular leukomalacia (PVL) and ventriculomegaly (VM) being associated with high mortality and adverse results in neurological development⁴.

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The neurological evaluation associated with neonatal brain ultrasonography, are quite efficient methods for assessment, as they are non-invasive, low cost and fast application methods with high diagnostic predictive value⁵.

In addition to being possible to perform it at the bedside using portable devices, maintaining the thermal and hemodynamic balance of critically ill newborns, it does not present harmful effects such as the use of ionizing radiation. It is known that small doses of radiation are potentially harmful to the newborn, particularly when serial examinations are necessary⁶.

The ultrasound examination is effective in the diagnosis and serves to refer the newborn to outpatient follow-up with a multidisciplinary team. Therefore, the objective of this work is to identify the main injuries found in TFUS of premature newborns in the ICU.

METHODS

Descriptive cross-sectional quantitative and retrospective study, carried out in the neonatal ICU of Maternidade Dona

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Íris, a reference hospital in Goiânia-GO.

The research was carried out from January to December 2019, including all newborns that went to the neonatal ICU during this period. The exclusion criterion was incomplete medical record.

For data collection, variables of the newborn and mother were used.

For the Mother: age, number of children, number of prenatal consultations, risk factors and type of delivery.

For the NB: Apgar of the first and the fifth minute of life, gestational age, gender and weight.

For TFUS: type of lesion presented.

The collected items were entered into an electronic spreadsheet (Excel, Microsoft Corporation, USA) and analyzed in gross values and percentages

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

RESULTS

Data from January to December 2019 with 306 newborns admitted to the ICU during this period were analyzed, of which 122 were considered term and 184 preterm. Of the 184 preterm infants, 34 records were excluded due to incomplete data, with 150 neonates being evaluated.

TFUS	N	%
Normal	114	76
Altered	36	24

Table 1 - Distribution of the results of TFUS performed in preterm on HMDI, Goiânia (GO), Brazil, 2020.

	Number of patients (N=36)	
	N	%
MATERNAL AGE		
≤ 17	2	5
18 – 30	23	64
≥31	11	31
NUMBER OF PREGNANCIES		
1	15	42
2-3	18	50
≥ 4	3	8

PRENATAL CONSULTATIONS		
< 7	30	83
≥ 8	6	17
TYPE OF CHILDBIRTH		
Cesarean	10	28
Normal	26	72
RISK FACTORS		
Yes	17	47
No	19	53
MAIN RISK FACTORS		
SHDP	4	24
Urinary tract infection	7	41
Membrane rupture	2	11
Use of legal and illegal drugs	4	24

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

	Number of patients (N=36)	
	N	%
GENDER		
Female	15	42
Male	21	58
GESTATIONAL AGE		
23 weeks	2	5
24 weeks	1	4
25 weeks	1	4
26 weeks	9	26
27 weeks	6	18
28 weeks	2	5
29 weeks	2	5
30 weeks	1	4
31 weeks	4	9
32 weeks	1	4
33 weeks	4	9
34 weeks	3	7

APGAR 1 ST		
< 7	26	72
≥ 8	10	28
APGAR 5 TH		
< 7	8	22
≥ 8	28	78
WEIGHT FOR GESTATIONAL AGE		
AGA	35	97
LGA	0	0
SGA	1	3
WEIGHT RANGE (IN GRAMS)		
<2,500	35	97
≥2,501	1	3

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

Anomalies found	N	%
Hemorrhage	33	91
Liquids	1	3
Leukomalacia	1	3
Dandy-Walker syndrome	1	3

Table 4 - Distribution of the main anomalies in the TFUS performed in preterm NBs at HMDI, Goiânia (GO), Brazil, 2020.

Hemorrhage	N	%
Grade I hemorrhage	8	24
Grade II hemorrhage	14	43
Grade III hemorrhage	9	27
Grade IV hemorrhage	2	6

Table 5 - Distribution of TFUS hemorrhages performed in preterm NBs at HMDI, Goiânia (GO), Brazil, 2020.

The average length of stay in the unit was 50 days and the death rate in this group was 11 newborns (31%) and the main TFUS anomaly found in the death group was grade III hemorrhage with seven patients. Extreme preterm infants with a gestational age of <27 weeks occurred in 19 fetuses (51%).

DISCUSSION

Premature newborns are exposed to a wide spectrum of clinically silent brain lesions, supporting a possible role in screening by brain ultrasound⁷. Another finding is that the lower the gestational age, the greater the intrinsic vulnerability of the developing brain, increasing the risk of developing brain damage, particularly when extrinsic factors, such as comorbidities, coexist⁸.

150 records of NBs who underwent TFUS admitted to the ICU were analyzed. Among those 114 were within the normal range and 36 with anomalies. The World Health Organization (WHO) defines premature births as those that occur after the 20th and before the 37th week of gestation².

The maternal profile is of women between 18-30 years old (64%), with two to three previous pregnancies (50%), who had less than seven prenatal consultations (83%), with vaginal delivery (72%) and who did not have risk factors (53%) and when they had urinary tract infection it was the most prevalent (41%).

The profile of the NBs was male in 58% of cases, extremely premature infants with gestational age of <27 weeks occurred in 19 fetuses (51%), first-minute Apgar less than 7 (72%) and fifth-minute Apgar greater than 8 (78%), although the majority had an adequate weight for gestational age (97%) in 97% of cases the weight was less than 2,500g.

In a subclassification, prematurity can be classified into three categories: mild, when it occurs between 32 and 36 weeks of gestation, moderate (28 and 31 weeks) and severe (below 28 weeks)², the study presented found the severe form. Egwu et al⁹ studied 99 premature newborns, 36 (36.4%) were between 28 and 31 weeks of gestation, while 63 (63.6%) were between 32 and 36 weeks of gestation. Therefore, investing in preventing premature birth and improving neonatal care interventions is necessary to avoid the risk of bleeding, especially in premature newborns⁹.

The main alteration found was hemorrhage (91%) and grade II the most prevalent (43%). Almeida et al¹⁰ evaluated 184 premature newborns in a study where the transfontanelle ultrasound revealed peri-intraventricular hemorrhage in 32 (74.4%) and periventricular leukomalacia in 11 (25.6%) newborns. Grade I hemorrhage was found in 20 (62.5%), grade II in five (15.6%) and grade III in seven (21.8%) newborns, according to Papile's classification. Vaginal delivery (p = 0.010), birth weight <1500 g (p = 0.024), gestational age at delivery ≤ 32 weeks (p = 0.018) and previous history of infection during pregnancy (p=0.013) were considered risk factors for intraventricular hemorrhage in premature newborns¹⁰.

Diwakar & Khurana⁷ evaluated 100 newborns for anomalies detected on cranial ultrasound of premature newborns, identifying hydrocephalus in 12%, intracranial hemorrhage in 6%, cerebral edema in 6%, periventricular leukomalacia in 2%, choroid plexus cyst in 1%, intraventricular septa in 1% and colpocephaly in 1%⁷.

Intraventricular hemorrhage (IVH) is a serious complication among premature newborns, which can result in hydrocephalus, cerebral palsy, behavioral disorders, learning difficulties or death⁹. The incidence of hemorrhage in babies <1000 grams is 50-60% and in babies from 1000 to 1500 grams, the incidence is 10-20%. Approximately 90% of bleeding occurs until the fourth postnatal day, with 50% occurring on the first postnatal day. Approximately 20-40% shows hemorrhage progression for 3-5 days. Babies with hemorrhage are at risk of hydrocephalus and white matter lesion¹⁰.

Hernandez et al¹¹ found 3% leukomalacia, which is considered a central nervous system injury secondary to a hypoxic-ischemic insult and affects more premature than full-term infants. However, the rates reported in the literature are between 2% and 25% in premature neonates. Accurate identification of white matter lesions in premature newborns is important to advise parents and direct these high-risk newborns to appropriate rehabilitation services¹².

In the Dandy-Walker malformation, which represents 2 to 4% of cases of congenital hydrocephalus, on cerebral ultrasound, it is possible to see a large posterior fossa, a small cerebellar remnant and an exuberant 4th ventricle¹³⁻¹⁴.

Stable premature babies with ≥ 25 weeks of gestation without intervening deterioration may not need repeated screening US after having performed two normal studies with an interval of ≥ 7 days. Unstable or extremely premature infants with <25 weeks of gestation may be subject to severe late changes and, therefore, need a repeat study before hospital discharge, even if two initial studies with an interval of ≥ 7 days are normal¹⁴.

CONCLUSION

150 exams were performed, 72% of which were normal and 28% abnormal, the main alteration found was hemorrhage 91% with grade II being the most prevalent with 43%.

The maternal profile showed that the majority were young patients, with no risk factor and good prenatal care.

The profile of the NBs was male babies with severe prematurity, weight below 2500g with high mortality in cases of grade III hemorrhage.

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