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RESEARCH ARTICLE

ETIOLOGICAL REVIEW OF BRAIN INJURIES ON CT SCANNING IN THE ASSESSMENT OF PSYCHOMOTOR DEVELOPMENT DELAY IN CHILDREN UNDER FIVE (5) YEARS OF AGE AT THE “LUXEMBOURG” MOTHER-CHILD CHU

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Abstract

Objective: Our work aimed to describe the scan semiology of lesions encountered in delayed psychomotor development (DPMD) in children under 5 years old at the Mother-Child University Hospital Center “Le Luxembourg”

Methodology: This is a prospective analytical and descriptive study carried out over a period of 18 months (from April 15, 2021 to September 15, 2022) in the radiology department of the CHU-ME Mère et Enfant “Le Luxembourg”. It concerned all patients aged 0 to 5 years admitted to the medical imaging department of the Luxembourg Mother and Child University Hospital for psychomotor delay who had undergone a brain scan. Children without psychomotor delay were excluded from our study.

Results: We retained 150 cases of psychomotor delay during our study period. The age group of 0 to 02 years was the majority (67%) with an average of 1.33 years, an extreme of 1 month to 5 years and standard deviation of 5.807. The male gender was in the majority with (55%) with a sex ratio of 1.22. The most common type of delivery was normal delivery with a frequency of 62.0%. Prematurity was the most represented obstetric risk factor (18.0%). Convulsion was the most represented neonatal risk factor (16.7%). Epilepsy was the most common postnatal neurological antecedent (6.7%). The scan result was abnormal in 75% of our patients. The lesions found were: anoxic-ischemic leukoencephalopathy (47%), hydrocephalus (17%), malformative lesions (7%), sequelae of brain infections (3%) and tuberous sclerosis of Bourneville (1%)

Conclusion: Childhood DPMD represents a major health problem with a relatively high prevalence. This study demonstrates the diagnostic value of CT in the exploration of RPM in children. Of the 150 patients explored, brain CT revealed a lesion in 75.0% of cases.

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Introduction:-

Psychomotor delay refers to any notable difference between a child's acquisitions and that of normal children of the same age group [1]. This is a real obstacle to the development of the child and his or her fulfillment in society. Psychomotor delay (RPM) is a frequent reason for consultation in pediatrics. Studies conducted by WHO from 1979 to 1999 revealed that more than 120 million people worldwide are affected by RPM with a prevalence among those under 18 years of age of 2 to 25 per 1000 in developed countries and 46 per 1000 in developing countries [2].

The prevalence of RPM is estimated in France at 1-3% in children under five (05) years old, i.e. 6,000-18,000 new cases per year. According to the Canadian Pediatric Society, PMR and intellectual disability represent 3% of the global pediatric population.

In Mali, the survey carried out by the Malian Association for the Fight against Mental Deficiency (AMALDEME) in 1987 found a prevalence estimated at 14.6% in a population of 9,000 children aged 0 to 5 years in the district of Bamako [2].

RPM has various causes. The diagnosis is clinical and this condition is characterized by the absence of curative therapy. The interest of imaging methods lies in the establishment of an etiological diagnosis, a prognostic evaluation and the assessment of a possible intrafamilial recurrence [3].

In the literature, it is remarkable to note that observations specifically concerning the radiological aspects of RPM in children remain very limited in number in Mali [3]. It is in this context that we established this study with the aim of studying the CT aspects of RPM in children under 5 years old at the Mother-Child Hospital and University Center in "Luxembourg".

Methodology:-**Study Framework:**

Our analytical and descriptive study took place in the radiology and medical imaging department of the Mother-Child University Hospital Center "Le Luxembourg".

Study Period:

The study took place over a period of 18 months from April 15, 2021 to September 15, 2022.

Sampling:

We collected 150 patients during our study period, who met the inclusion criteria.

Inclusion Criteria:

All patients aged from 0 to 5 years admitted to the medical imaging department of the Luxembourg Mother-Child University Hospital for psychomotor delay who have received a brain scan.

Non-Inclusion Criteria:

Children without psychomotor delay.
Children whose parents have not given consent.

Data Collection Method And Technique:

The supports used were: medical files of patients, individual investigation sheets and reports.

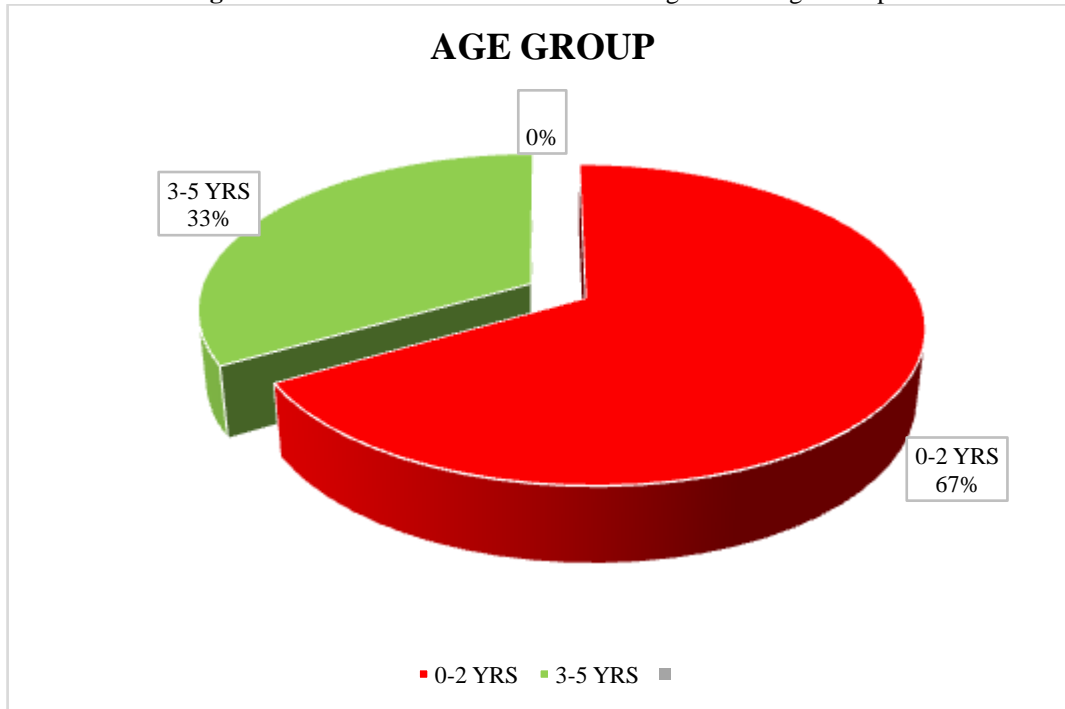
Materials Used:

The equipment with which the examinations were carried out was a HITACHI SUPRIA 16 BARRETTES brand CT scanner equipped with a CARESTREAM DRY VIEW 5950 brand printer: (installed in 2015)

Results:-

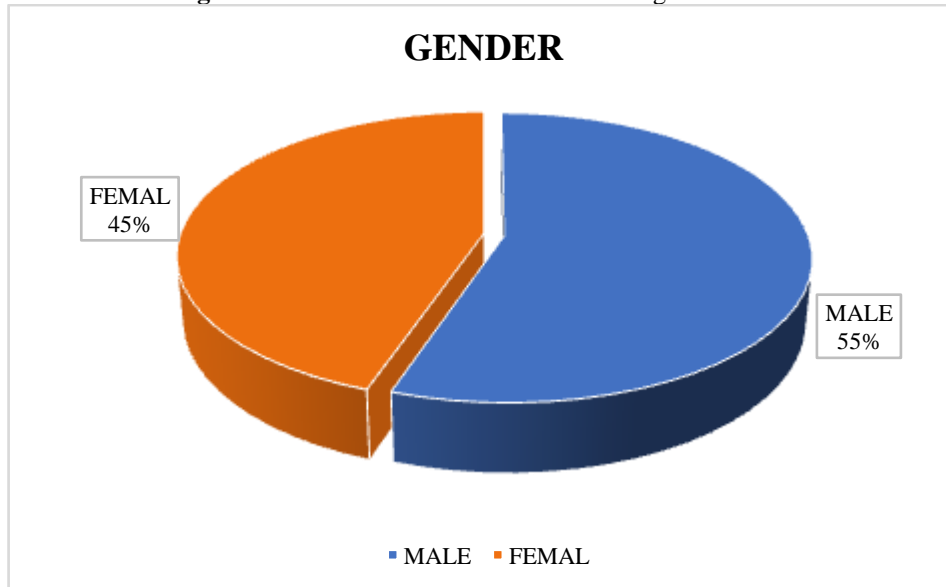
We collected a total of 1459 CT (brain) examinations during our study period, including 175 cases of PROM. We retained 150 cases meeting our criteria, i.e. a frequency of 10.3%.

Figure 1:- Distribution Of Patients According To The Age Group.



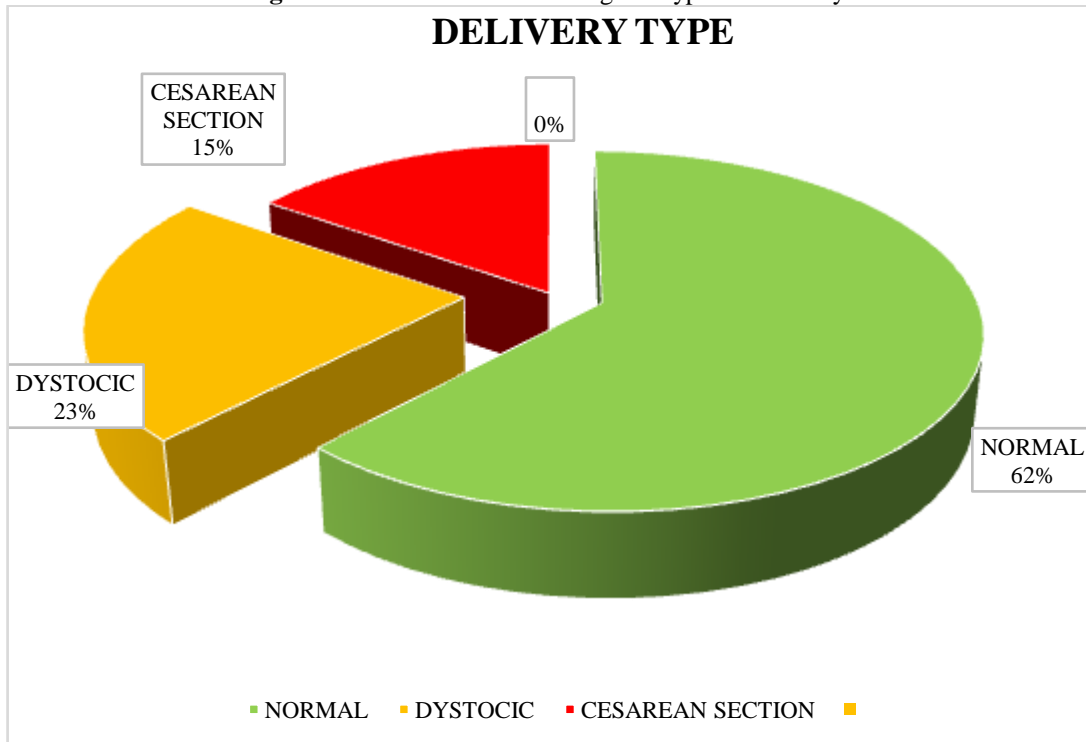
The age group 0 to 02 years was in the majority with 67.0%, an average of 1.33 years, an extreme of 1 month to 5 years and standard deviation of 5.807.

Figure 1:- Distribution Of Patients According To Gender.



The male gender was in the majority with 55% with a sex ratio of 1.22.

Figure 3:- Distribution According To Type Of Delivery.



In our study, normal delivery was the majority with 62.0% of cases.

Table I:- Distribution According to Obstetric Risk Factor.

OBSTETRIC RISK FACTORS	NUMBER	PERCENTAGE%
ABSENT	114	76,0
PREMATURITY	27	18,0
POST-TERM	4	2,7
MATERNAL-FETAL INFECTION	4	2,7
ULTRASOUND ABNORMALITY	1	0,7
TOTAL	150	100

In our study, prematurity was the most represented obstetric risk factor with 18.0%.

Table II:- Distribution According to Neonatal Risk Factor.

NEONATAL RISK FACTORS	NUMBER	PERCENTAGE %
ABSENCE OF RISK FACTORS	105	70,0
NEONATAL HYPOGLYCEMIA	4	2,7
DEEP JAUNDICE	16	10,7
CONVULSION	25	16,7
TOTAL	150	100

In our study, convulsion was the most represented neonatal risk factor with 16.7%.

Table III:- Distribution According to Postnatal Neurological History.

POSTNATAL NEUROLOGICAL HISTORY	NUMBER	PERCENTAGE %
NOT ATCD	132	88,0
EPILEPSY	10	6,7
HEAD TRAUMA	5	3,3
CNS INFECTION	3	2,0
TOTAL	150	100

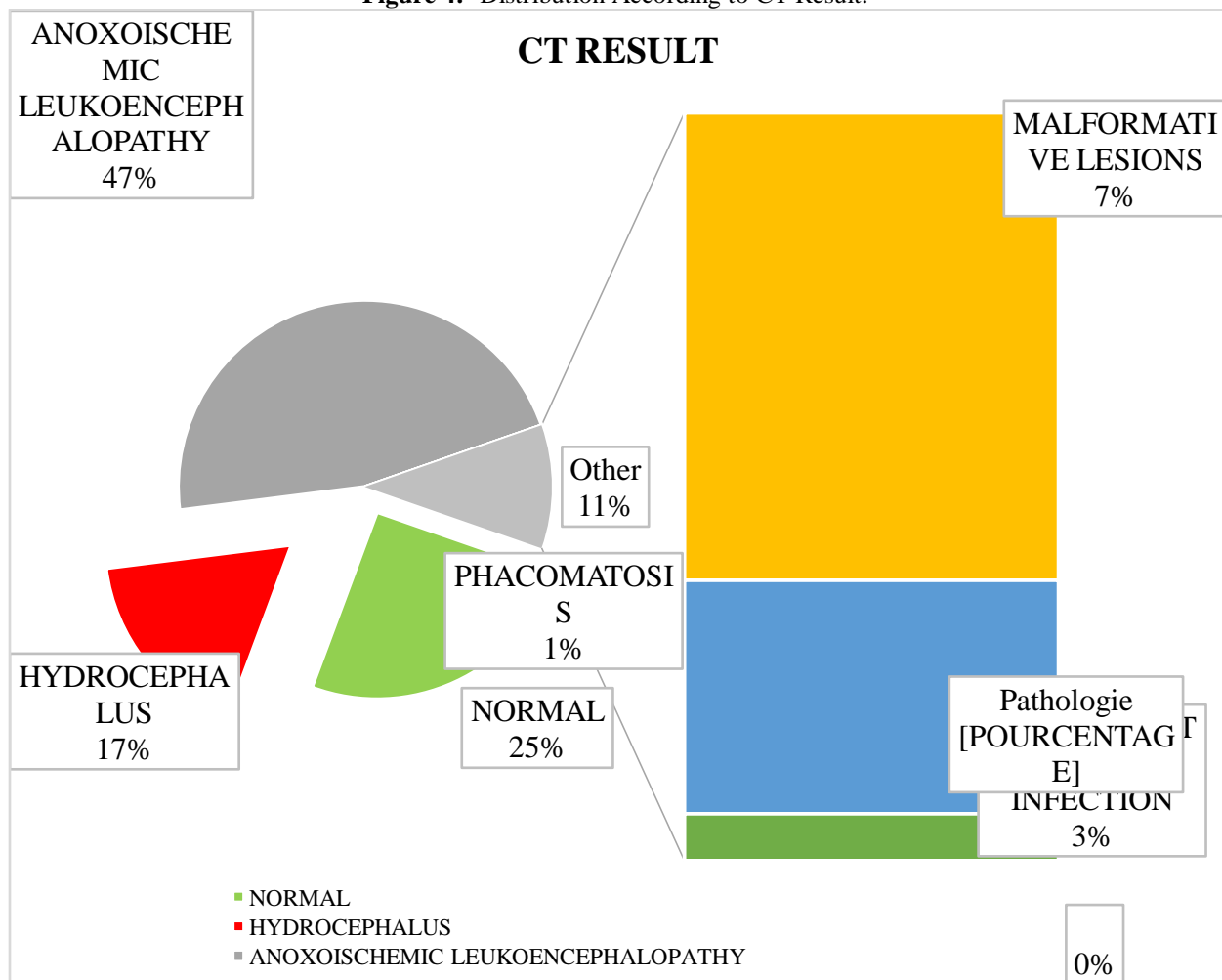
In our study, epilepsy was the most represented postnatal neurological antecedent with 6.7%.

Table IV:- Distribution According to Clinical Information of CT :

CLINICAL INFORMATION	NUMBER	PERCENTAGE %
ISOLATED DIET	33	22,0
CRANIAL PERIMETER ABNORMALITY	45	30,0
PERINATAL ANOXIA	15	10,0
HEMIPARESIS	5	3,3
CEREBRAL PALSY	8	5,3
HEMIPLEGIA	12	8,0
SEIZURES	14	9,3
AXIAL HYPOTONIA	9	6,0
BEHAVIORAL DISORDERS	9	6,0
TOTAL	150	100

In our study, cranial perimeter abnormality was the majority, i.e. 30.0%.

Figure 4:- Distribution According to CT Result.



In our study, 75% of patients had an abnormal scan result (pathology).

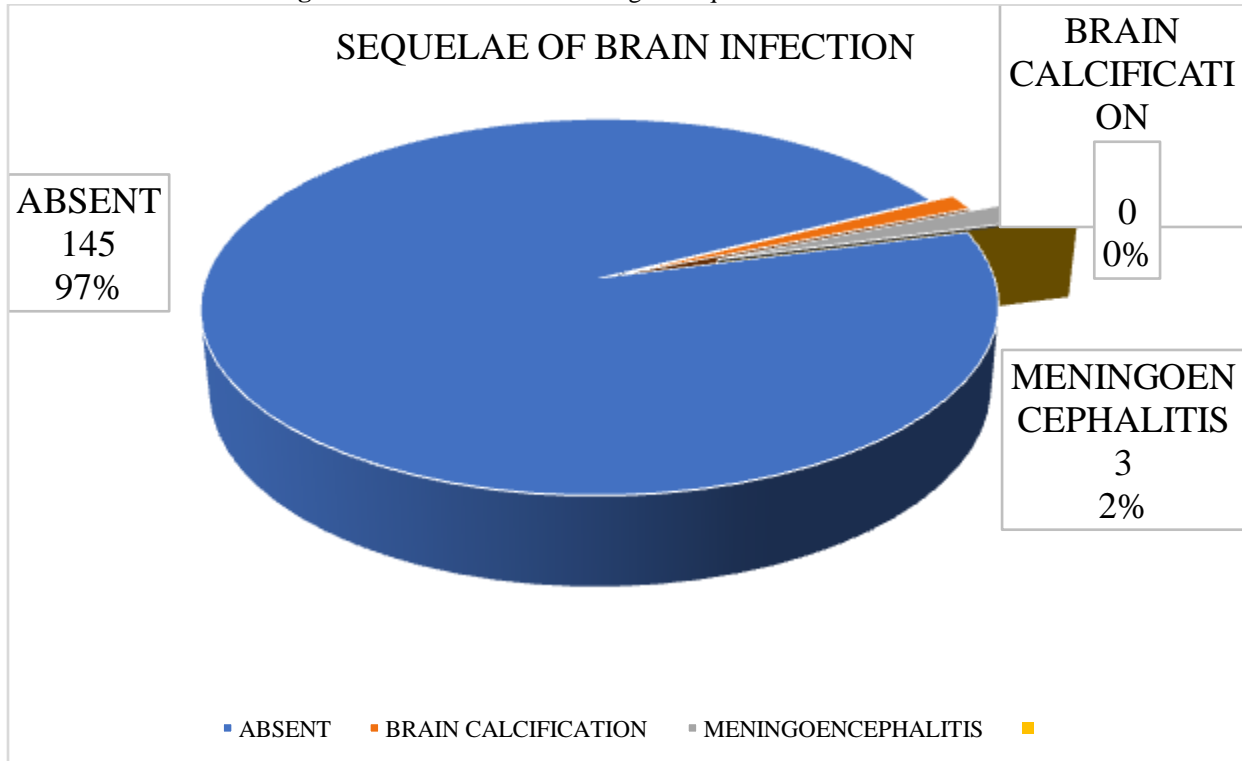
Table V:- Distribution According to Hydrocephalus :

HYDROCEPHALUS	NUMBER	PERCENTAGE %
ABSENT	124	82,7
UNIVENTRICULAR	2	1,3
BI-VENTRICULAR	4	2,7

TRI-VENTRICULAR	12	8,0
TETRAVENTRICULAR	8	5,3
TOTAL	150	100

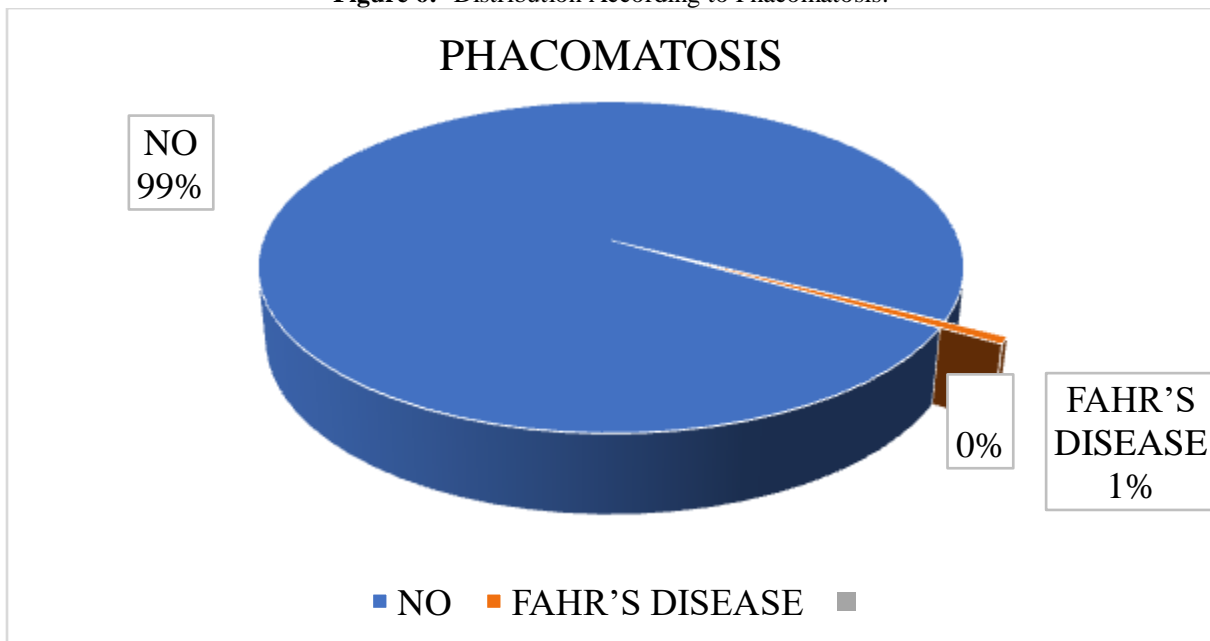
The tri-ventricularhydrocephalus was the mostrepresentedwith 8.0%.

Figure 5:- Distribution According to Sequelae of Brain Infection.



In ourstudy, 96% of patients had no after-effects of brain infection.

Figure 6:- Distribution According to Phacomatosis.



In ourstudy, 99% of patients did not have phacomatosis.

Tables VI:- Distribution According to Malformative Lesions.

MALFORMATIVE LESIONS	NUMBER	PERCENTAGE (%)
ABSENT	140	93,3
DANDY WALKER	3	2,0
SUBARACHNOID CYST	1	0,7
SEMILOBAR HOLOPROENCEPHALY	1	0,7
MENINGOENCEPHALOCELE	5	3,3
TOTAL	150	100

In our study, meningoencephalocele was the most observed malformative lesion with 03.3%.

Tables VII:- Distribution According to Anoxo-Ischemic Leukoencephalopathy.

ANOXIC-ISCHEMIC LEUKOENCEPHALOPATHY	NUMBER	PERCENTAGE (%)
ABSENT	80	53,3
BRAIN ATROPHY	40	26,7
PORENCEPHALIC CAVITIES	7	4,7
VASCULAR LEUKOPATHIES	3	2,0
RASMUSSEN SYNDROME	1	,7
CEREBRAL ISCHEMIA	19	12,7
TOTAL	150	100

In our study, 26.7% of patients had cortical atrophy.

Iconography:**Observation 1:**

CHILD. M S 06 months, sex: F Sent on 08/08/2023 to the department for axial hypotony.

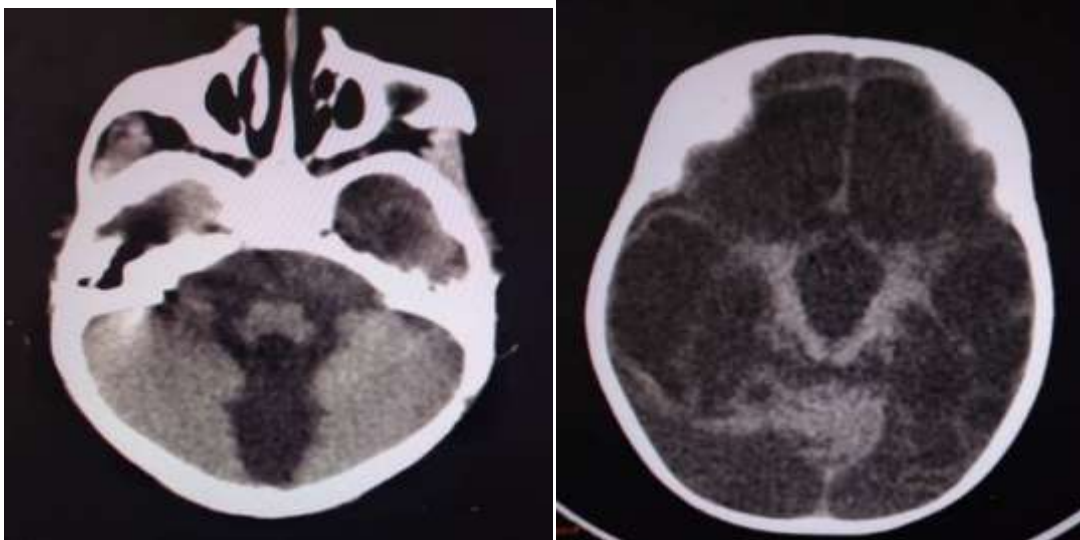


Figure 7 and 8:- Axial CT sections without PDC injection showing areas of bilateral hemispherical cortico-subcortical hypodensity with porencephalic cavities associated with significant enlargement of the furrows, lateral ventricles, V3 and V4 (multicystic encephalopathy with significant cerebral hypoxia).

Observation 2:

CHILD. B D 09 months, gender: M Sent on 05/10/2023 to the macrocraniadepartment.

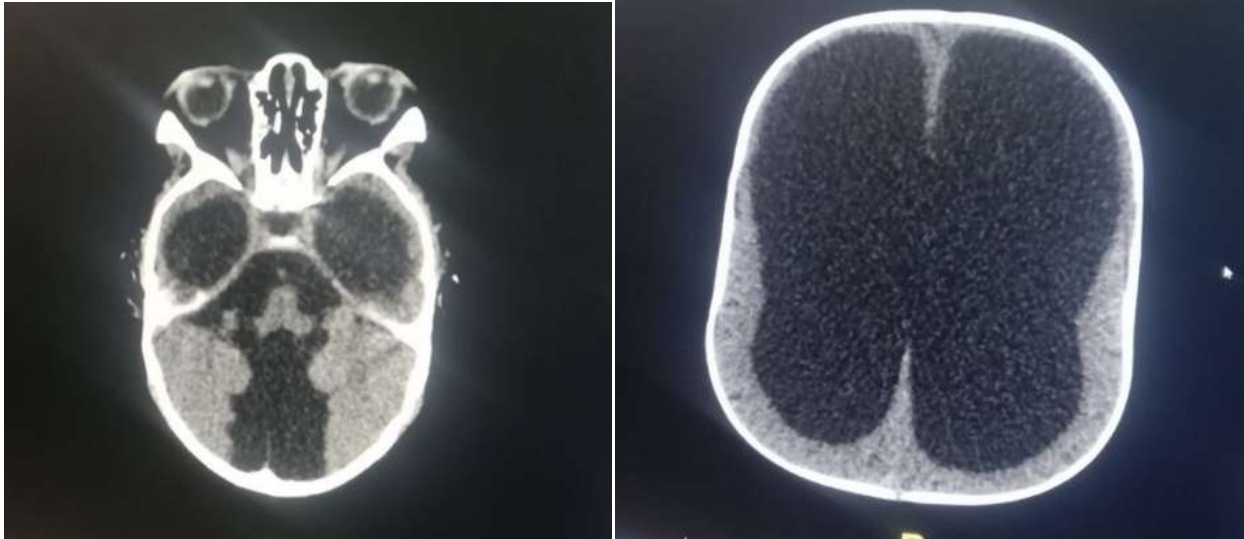


Figure 9 and 10:- Axial CT section without IV of PDC showing partial agenesis of the vermis associated with a cystic formation of the posterior fossa communicating with V4 responsible for supratentorial hydrocephalus suggesting: a true **Dandy Walker malformation**.

Observation 3:

INFANT S T 01 months, gender: M Addressed on 08/18/2023 to the department for Hypertonia of the upper and lower limbs altered consciousness.

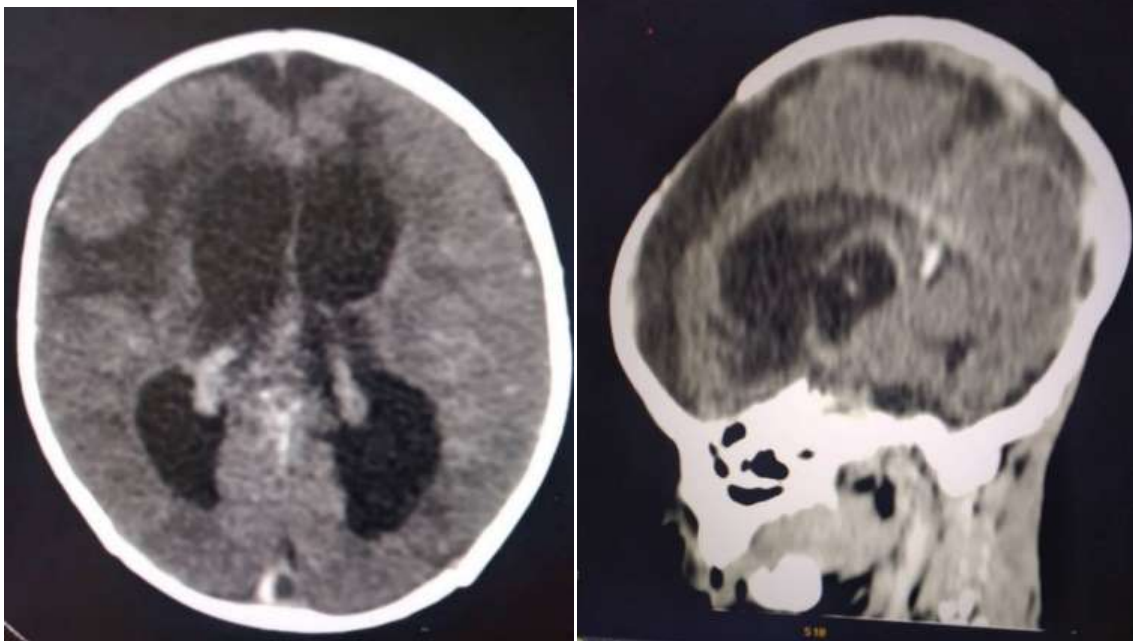


Figure 11 and 12:- Axial brain CT section after injection of contrast product.

Bilateral cortico-subcortical parenchymal hypodensity and periventricular white matter not enhanced after PDC injection,

Widening of cortico-subcortical furrows, sylvian valleys and ventricular systems, spontaneous hyperdensity of bilateral parenchymal punctiform NGCs: CT appearance of anoxo-ischemic encephalopathy associating significant cortico-subcortical atrophy after effect.

Observation 4:

INFANT B G B 01 months, sex: M Addressed on 08/08/2023 to the department for Hypertonia of the upper and lowerlimbsalteredconsciousness.



Figure 13 and 14:- Axial CT sections without injection of contrastproductrevealingwidening of the lefthemispheric subcortical furrowswith attraction and dilation of the ipsilateralventricle: appearance of leftcerebralhemi-atrophy.

Observation 4: INFANT. S D, 11 months, sex: M Sent on 08/15/2023 to the service for delay in psychomotor acquisition.

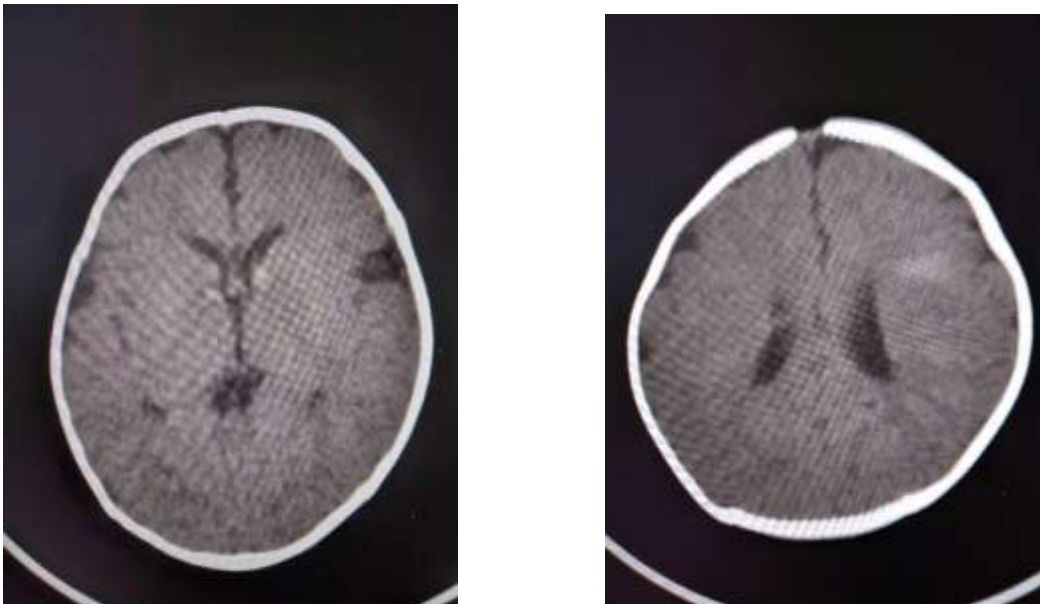


Figure 15 and 16:- Axial CT sections without injection of contrastproducthighlightingsubependymal calcifications associatedwith a discreetwidening of bilateralcorticosubcorticalfurrows: appearance of tuberoussclerosis of Bournéville.

Comments and Discussion:-

Duringthisstudyweencountered certain difficultiesrelating to certain clinical information, whichwas not available and technical breakdowns of the deviceamongothers.

Sociodemographic Data: **Age**

The age group most represented in our study was that of 0 - 02 years old with 67%. This age range is comparable to those obtained by M K Dembélé with 0 - 03 years in Mali [4] and by R. L. Andrianina [5] with 01 months - 03 years in Antananarivo (Madagascar) [5]. This could be explained by the fact that this age range essentially constitutes the diagnosis period, following either the parents' observation, or during a clinical examination.

 Sex

We noted a male predominance of 55% with a sex ratio of 1.22. This male predominance was found among certain authors such as M K Dembélé in Mali [4] and R. L. Andrianina in Antananarivo (Madagascar) [5]

Clinical Data: **CT Indications**

In our study, PC abnormalities were the main indication, i.e. 30%. This result is comparable to that of Dembélé [4] who found 23.77%. This explains the fact that brain lesions alone constitute the majority of RPM pictures.

 Risk Factors

In our study, prematurity was the most represented obstetric risk factor with 18.0%. This is comparable to that obtained by Dembélé M K [4] who found 20.49% and by R. L. Andrianina [5] with 19.7%.

In our study, convulsion was the most represented neonatal risk factor with 16.7%. This result is comparable to that obtained by R L adrianina who found 22.0% of cases presenting convulsive seizures

In our study, epilepsy was the most common postnatal neurological history with 6.7%.

 CT Results

CT was pathological in 75% of cases. This result is comparable to that of Dembélé M K [4] who found 72.13%. Our result is higher than the values reported by Bouhadiba and Demaerl (65.5%) [6], slightly lower than those reported by N. ALIOU et al (83%) [7].

 Anoxo-Ischemic Leukoencephalopathy

In our study, anoxic-ischemic leukoencephalopathy was the most frequently encountered lesion with a frequency of 47%; this result is comparable to that of Amadou et al [8] who found 51.66% of cases.

 Malformation

Brain malformation represented 7% of cases. This result is lower than the values found by certain authors such as Dembélé [4] with 14.75%, Amadou et al [8] with 11.16%, Majnemer A and Shevell [3] with 21.64%

Hydrocephalus :

Hydrocephalus accounted for 17.0%. This result is higher than those of M K Dembélé [4] with 12.3%; but lower than the values obtained by R L Adrianina with 29.9% and by Amadou et al 23.14% of cases. This could be due to sample sizes.

 Sequelae of Brain Infections:

The after-effects of infections represented 3.0% of cases. This result is lower than the values obtained by Dembélé, Majnemer A and Shevell [3] with 5.74% and 10.27% respectively.

Conclusion:-

Childhood motor psycho delay (MPD) represents a major health problem with a relatively high prevalence. This study demonstrates the diagnostic value of CT in the exploration of MPD in children; of the 150 patients explored, brain CT revealed a lesion in 75.0% of cases.

PC anomaly represented the main indication for CT with 30.0% of cases, affecting boys more than girls.

The main CT lesions were anoxic-ischemic leukoencephalopathy, hydrocephalus and malformative lesions; i.e. 47.0%, 17.0% and 7.0% of cases respectively.

In the cerebral exploration of children with psychomotor delay, it is essential that this morphological exploration is integrated into a complete evaluation carried out in a specialized environment.

CT, although non-specific, helps with etiologic diagnosis, its diagnostic profitability justifies its implementation.

It makes it possible to carry out a brain injury assessment, to label a malformation and to avoid the risk of intrafamilial recurrence.

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