RETROSPECTIVE STUDY OF CT BRAIN IMAGING FINDINGS INDICATED FOR INFANTS AT A TERTIARY CARE HOSPITAL

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Abstract

Computed tomography in the diagnosis of pathologies in children is becoming increasingly popular.

The aim: to study findings of referrals for CT scans (Computerised Tomography) of the brain in children in the department of Radiology in a developing environment.

Materials and methods: retrospective imaging observational study was done in a 1000 bedded tertiary care hospital in South India in the year 2022 from April to August for 5 months under 16 slice CT scan. Cases are referred from the department of Pediatrics to the department of Radiology as part of the routine clinical evaluation and treatment protocol.

Results: Our sample includes 100 infants; after exclusion criteria total of 60 infants' brain CTs were taken into account, and analysed their imaging from radiology department records. Of 60 cases, 18 (30 %) showed HIE Pattern, and 42 (70 %) had normal plain CT Brain findings. However, due to clinical signs and symptoms, they are evaluated under contrast CT imaging (after checking creatinine levels), showing 20 cases (33.3 %) are standard, 10 cases (16.6 %) show meningitis, and 2 cases (3.3 %) show SOL. Out of 18 cases of HIE, 10 cases (16.6 %) are under less than 6 months and they undergone neuro sonogram showing 4 cases (6.6 %) normal NSG, 2 cases (3.3 %) showing grade IV HIE, another 2 cases (3.3 %) showing grade II, III HIE Findings.

Conclusions: Our study concluded that plain CT brain showed normal in the majority of the cases which came to the department of Radiology after admission to the hospital. Those cases with strong clinical history are evaluated with contrast CT and evaluated the findings. After contrast imaging, most cases showing their infective, obstructive, and other causes of illness are interpreted. However, its role is minimal for seizures in which CT/CECT shows normal study. Under 6 months, NSG is a suitable method for evaluating and screening the infant's brain.

Keywords: Hypoxia ischemic encephalopathy (HIE), seizures, Infants, computerised tomography(CT), HIE (Hypoxic ischemic encephalopathy), Neurosonogram (NSG)

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1. Introduction

CT (computerised tomography) is one the speediest imaging modalities and gives the internal organs' better orientation [1]. In addition, it gives the thins slides of body images in the axial plane with desired thickness and desired part of the body. Neurological and abdominal disorders in children are usually sources of great apprehension in parents and paediatric surgeons. Therefore, the use of Computed Tomography (CT) scans in the diagnosis of these disorders has increased

rapidly [2]. However, CT involves much higher radiation than plain radiographs and, in developing countries, is further limited by availability and cost [3]. Consequently, there is a need to ensure that appropriate protocols are employed to avoid misuse.

Infants are the ones whose age is less than 1 yr.; during growth in society, they may predispose to various pathologies [4]. Therefore, our study mainly focused on the Infants who came to the hospital and were advised for a brain CT scan to evaluate pathology from the Department of Paediatrics.

The aim: to study findings of referrals for CT scans (Computerised Tomography) of the brain in children in the department of Radiology in a developing environment.

2. Materials And Methods

Its retrospective study of infants' CT brain from April to August 2022 (5 months duration) was done in a 1000 bedded pediatric hospital indicated by the department of paediatrics in the treatment evaluation process. We have recorded data with selection criteria as follows.

Inclusion criteria: Infants with normal metabolic, normal TIFFA (Targeted Imaging For Fetal Anomalies)during their gestation.

Exclusion criteria: Abnormal TIFFA, abnormal metabolic disorders, abnormal structural pathology, any trauma after birth-related events and cases where the moment artefacts while doing CT scan.

A total of 100 infants were evaluated, out of 40 infants were excluded due to various motion artefacts (raised due to moment). If the brain CT is standard but clinically significant and radiologically significant, we have done contrast CT for better evaluation and interpreted the images. While taking contrast, we have taken the infant's weight into account.

Ethical approval and Informed consent were obtained from all patients
(ECR/180/OMC/AP/2020/07/45 dated 04/12/ 2020).

If the infant showed HIE features and is less than 6 months, we analysed the neurosonogram images of the brain and analysed, and interpreted them.

A retrospective imaging evaluation was done and analysed using SPSS software.

3. Results

It is a retrospective analysis of imaging data documented in the Department of Radiology during that period.

Of 60 infants, 42 (70 %) showed standard plain CT, and 18 (30 %) infants showed HIE features.

Out of 60 infants, 28 (46.6 %) are female infants, and 32 (53.4 %) are male infants (**Fig. 1**).

Fig. 1. Gender distribution among study participants

In contrast to CT brain, 20 (33.3 %) infants showed standard imaging, 18 (30 %) infants showed HIE, 10 (16.6 %) infants showed meningitis features, and 2 infants (3.3 %) SOL (space-occupying lesions) (**Fig. 2**).

In HIE infants, only 10 (16.6 %) infants are less than 6 months, out of which 4 infants (6.6 %) showed normal neurosonogram. 2 infants (3.3 %) showed grade I to II changes and reaming 2 infants (3.3 %) showing grade IV changes.

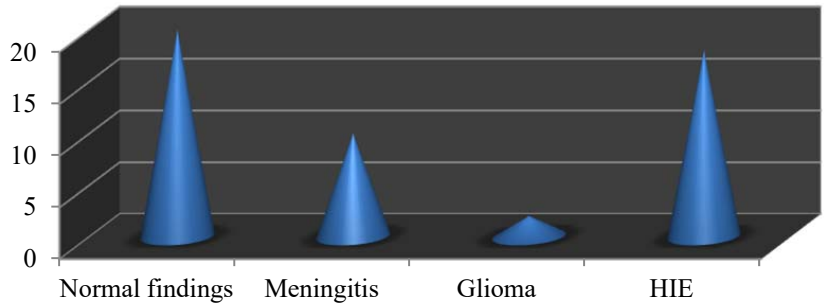

Fig. 2. Distribution of CT imaging spectrum

Fig. 3. Axial section of Plain CT brain showing EDH with mass effect on the ipsilateral lateral ventricle

Fig. 4. Coronal section of CT brain showing absence of septum pellucidum and hypoplastic optic nerve noted

Fig. 5. Axial section of Contrast CT brain showing thickened enhancement of ventricular walls with a dilated lateral ventricles-a case of obstructive hydrocephalous with ventriculitis

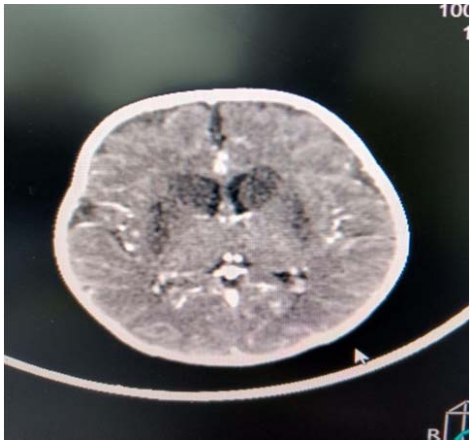

Fig. 6. Axial section of Contrast CT brain showing hypodense areas bilateral caudate and putame.-A case of Leigh disease

Fig. 7. NSG-of a3 month old baby showing hyperechogenic area involving the left capsuloganglionic region with an intraventricular extension-A case of Grade III HIE with IVH

Fig. 8. Axial section of Contrast CT brain showing vividly enhancing median peocencephalic vein (MPV)-Case of Vein of Glan Aneurysmal Malformation.

4. Discussion

After sonography which is the preferred imaging method for screening the central nervous system (CNS) during infancy, a CT scan is the following preferred method for all other ages .[5] However, the risk of this method should be considered alongside its advantages and radiation dose reduction should be employed where necessary [5, 6]. However, the small proportion of children with normal scans indicates a good selection by referring clinicians.

In the study, female infants are more seen with abnormal CT scan, correlating with the study done by Fateme Eghbalian et al. [7]. In contrast, male infants comprised the majority of patients in the other studies and males was a determining risk factor for neonatal seizures [8–10] (**Fig. 3**).

In our study, out of 60 infants, 30 % showed HIE features. Hypoxic ischemic encephalopathy (HIE) is one of the most severe birth complications affecting full-term infants. It occurs in 1.5 to 2.5 per 1000 live births in developed countries. HIE is a brain injury that prevents adequate blood flow to the infant's brain, resulting from a hypoxic-ischemic event during the prenatal, intrapartum or postnatal period [11]. By the age of 2 years, up to 60 % of infants with HIE will die or have severe disabilities, including mental retardation, epilepsy, and cerebral palsy (CP) [11–13] (**Fig. 4**).

The most frequent referrals were for a brain scan (**Fig. 5**). This agrees with a study by Anas et al. [14] in Kano and may be related to cheaper options like plain radiography, contrast studies and ultrasonography in examinations involving other parts of the body. A study by Nzeh et al. [15] revealed that the most prevalent suspected abnormalities of the paediatric brain could be evaluated by ultrasound in much younger children before fusing the fontanelles. The use of ultrasonography in the evaluation of pathologies in younger children is essential as children are known to be more radiosensitive than adults, as seen in studies by Brenner et al. [6] and Donnelly et al. [5] (**Fig. 6**).

In conclusion, the high yield of the diversity of CT scan findings in the children in our study justifies the appropriate use of CT scan in the diagnosis and management of suspected brain pathologies in areas where magnetic resonance imaging scan is unavailable or where ultrasonography cannot be done following the fusion of the fontanelles in younger children (**Figs. 7, 8**). Consider the risk-to-benefit profile of the proposed examination and potential imaging alternatives that would provide the same or better diagnostic information and confirm a valid clinical indication [16, 17]. The preparation for timely treatment includes the entire spectrum of potential adverse events and prearranged response planning with the availability of appropriately trained personnel, equipment, and medications [18–20].

Although cost should be considered, the patient should be given a chance for an appropriate workup to avoid delay in diagnosis. A universal insurance scheme that includes both the public and private workforce can solve the cost problem. Pediatrics CT scan is a crucial diagnostics tool with lots of potential and flexibility [15]. It should, however, be used with great caution as stipulated by the "as low as reasonably achievable" (ALARA) principle to reduce radiation dose to the patient. It

is evident from this study that the environment is underserved, and therefore Public Private Partnership (PPP) is recommended to expand CT facilities in this environment [5].

The limitation of the study is that CT is costly, and it is giving the ionising radiation to ever newer advances came in CT as ALARA (as low as reasonably achievable).

Prospects for further research. Our study denotes the need for CT as a primary tool that works as non-mobile units. It would be a great healthcare revolution if we go ahead with mobile CT unit vehicles, which can go interiors of the country, and people can get a consultation with telemedicine.

5. Conclusion

Our study stated that infants with male gender were more admitted than females. Most cases (70 %) show normal CT brain parenchyma; after contrast imaging, they are evaluated for other pathologies like meningitis and other SOL (space-occupying lesions). Few cases showed HIE (hypoxic ischemic encephalopathy) on further imaging, with the neurosonogram majority as expected at an early age.

It is concluded that infants with clinical features even showing normal plain CT find it better for the patient to do contrast imaging to evaluate disease pathology. How CT imaging will take very less time, thin slices of imaging will be done (best chosen as infants under oral sedation), and its imaging pattern will be best evaluated.

Conflict of ınterest

The authors declare that there is no conflict of interest concerning this paper, the published research results, the financial aspects of conducting the research, obtaining and using its results, and any non-financial personal relationships.

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