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Umran M.M. ✉, Abdulsattar O.A., Almusawi A.A.H.
University of Babylon, Babylon, Iraq

Brain MRI Findings of Referred Children with Delayed Milestones

Conflict of interest: nothing to declare.
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Contacts: medicalresearch82@yahoo.com

Abstract

Introduction. The developmental delay (DD) is a condition when children cannot acquire appropriate skills at the expected age. Brain MRI is one of facilities used to distinguish DD. Developmental delay may occur against the background of organic damage to the central nervous system, including those manifested by changes on MRI.
Purpose. To assess the brain MRI findings in children with developmental delay and to estimate the prevalence rate of abnormal brain MRI in those children.
Materials and methods. A descriptive study on the brain MRI of 57 children with DD was conducted from September 2022 to April 2023 at Department of Radiology, Al-Hillah Teaching Hospital. Neuroimaging of all cases were done beyond proper taking of history and examination. Brain MRI were acquired on a 1.5 Tesla (Philips N.V.2021 MRI unit 1.5 Tesla, SRN: 32534).
Results. The mean age was 5.53±4.09 years. Male to female ratio was (1:1). Of 57 children, 26 (45.6%) were complained of speech plus other delayed types. Global developmental delay (GDD) discovered in 21 (36.8%), specific developmental delay (SDD) found in 33 (57.9%), and global developmental delay plus convulsions (GDDC) in three cases (5.3%), with a significant difference (p=0.01). Normal brain MRIs were seen in 32 (56.1%) of cases.
Conclusion. The brain MRI very important in detection of DD in pediatric age groups. Early and easily diagnosis of DD by brain MRI is one of option in the management of these etiologic and pathophysiologic conditions in Iraq. Speech and sitting delay represent the major of DD.
Keywords: developmental delay, agenesis of corpus callosum, MRI, global developmental delay

Умран М.М. ✉, Абдулсаттар О.А., Альмусави А.А.Х.
Вавилонский университет, Вавилон, Ирак

Результаты МРТ головного мозга у детей с задержкой развития

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Резюме

Введение. Задержка развития (ЗР) – состояние, при котором дети не могут приобрести соответствующие навыки в ожидаемом возрасте. МРТ головного мозга – один из методов диагностики ЗР. ЗР может возникнуть на фоне органических поражений ЦНС, в том числе проявляющихся изменениями на МРТ.
Цель. Оценить результаты МРТ головного мозга у детей с ЗР и уровень распространенности таких аномалий.
Материалы и методы. Описательное исследование МРТ головного мозга у 57 детей с ЗР проводилось с сентября 2022 года по апрель 2023 года в отделении радиологии клинической больницы Аль-Хилла. Нейровизуализация всех случаев проводилась без сбора анамнеза и обследования. МРТ головного мозга проводили на аппарате MPT Philips N.V.2021 1,5 Тесла, SRN: 32534.
Результаты. Средний возраст детей составил 5,53±4,09 года. Соотношение мальчиков и девочек составляло 1 к 1. Из 57 детей у 26 (45,6%) имелись задержка речи и другие признаки ЗР. Общая ЗР (ОЗР) обнаружена в 21 (36,8%) случае, специфическая ЗР (СЗР) – в 33 (57,9%), ОЗР и наличие судорог – в 3 случаях (5,3%), различия статистически значимы (p=0,01). Нормальные показатели МРТ головного мозга наблюдались в 32 (56,1%) случаях.
Заключение. МРТ головного мозга играет важную роль в выявлении ЗР в детских возрастных группах. Ранняя и простая диагностика ЗР с помощью МРТ головного мозга является одним из вариантов ведения этих этиологических и патофизиологических состояний в Ираке. Задержка речи и появления навыков сидения представляет собой основную причину ЗР.
Ключевые слова: задержка развития, агенезия мозолистого тела, МРТ, общая задержка развития

■ INTRODUCTION

Development is a complex process which continuous till maturity and it is parallel to the growth of children [1]. A various relations and skills with their surrounding

environments establish by children during the development [2]. At the expected age, when children cannot gain/acquire appropriate developmental skills, those consider as the developmental delay (DD) [3].

Global developmental delay (GDD) is defined as a significant delay or below the appropriate standard in two or more developmental domains, which is a subset of developmental disorders divided into static and progressive disorders in the central nervous system [1].

The diagnosis of DD is not immediately done after birth, but done during infancy or early childhood. The diagnosis significantly impedes quality life of the patient and full participation in the life of the family, school and community. In such cases it depends on the clinician's ability to detect and diagnose the cause with a multi-modality approaches which include neuroimaging [4]. There are wide range of etiologies of DD include metabolic, genetics, endocrines, infections, vascular, traumatic, toxins, malformation syndromes, tumors and environmental reasons [2], have adverse events of delay in the milestone which can be evaluated using four domains of gross motor, fine motor, cognition, speech/language, and personal/social (performance at least two SD below the mean of age appropriate) [1]. The prevalence rate of DD constitute nearly 5–10% of patients presenting as outpatients at various medical centers [5].

DD does not represent a diagnosis, but is a term used in different clinical situations and prognosis, which cover a wide range of etiologies [3]. Careful evaluation, examination serological, metabolic, strip brain, genetic analysis and neuroimaging investigation can reveal a reason in 55–85% [6].

Brain MRI is one of the major tool used to detect DD, and based on previous studies, about 60% of cases have abnormal brain MRI [1, 2]. MRI provide information about the case, the rate and type of brain abnormalities; help to identify illness and prognosis, preventing the recurrence and parent counseling [5].

MRI Brain is necessary to get actual picture of the abnormality leading us towards the accurate diagnosis which further help the clinician. MRI does not diagnose DD, only developmental anomalies/malformations, consequences of strokes, injuries, etc. [1, 7].

■ PURPOSE OF THE STUDY

To assess the brain MRI findings in children with developmental delay and to estimate the prevalence rate of abnormal brain MRI in those children.

■ MATERIALS AND METHODS

Study design and setting

A cross-sectional study on the brain MRI of 57 children with DD was conducted over a period of six months from September 2022 to April 2023 at Department of Radiology, Al-Hillah Teaching Hospital. Neuroimaging of all cases were done beyond proper taking of history and examination.

Data collection

These include age of child, gender, feeding (breast, bottle or mixed), maternal disease (DM, HT, polyhydraminos or oligohydramnios), delivery mode (CS or NVD), and order of child in family. Data of DD include GDD or SDD or GDDC. MRI findings include (Non-specific; Congenital and developmental abnormalities; Detectable syndromes; Traumatic

and neurovascular diseases; Metabolic and degenerative diseases; and Neoplastic or non-neoplastic), and MRI structures according to Widjaja et al. [8] protocols.

Inclusion Criteria:

1. Children clinically detected with DD.
2. Age between three months to 16 years-old.
3. Delayed milestones history.
4. Epilepsy.
5. Mental retardation.
6. Neurological deficit.
7. Birth history of risky events (antenatal, intra-natal, and post-natal).
8. Maternal risk factors (medical history, drug intake, alcohol ingestion, tobacco smoking).
9. Intra-natal complications (CS delivery, asphyxia and low birth weight).

Exclusion criteria:

1. Age below three months and above 16 years-old.
2. Genetic disorder and syndromes.
3. MRI contraindication.
4. Hypersensitivity to contrast.

MRI protocols

Brain MRI were acquired on a 1.5 Tesla (Philips N.V.2021 MRI unit 1.5 Tesla, SRN: 32534) with a radiofrequency head coil.

MRI signals and sequences

Axial T1 and T2, DWI, ADC map, Axial T2 FLAIR, Sagittal T1 and T2, Coronal T1 and T2 and Gadolinium-based contrast medium.

DWI

In addition, the duplication the DWI sequences and then added the parallel imaging techniques for comparing the outcome image with that one obtained without parallel imaging technique.

Image analysis

DWI before and after using the parallel imaging technique compared with sense and for measurements of the degree of geometric distortion in DWI compared with T2-TSE.

Statistical analysis

Statistical package for social science (SPSS version 24.0, Chicago: SPSS, Inc.) was used. Results were described in the form of frequencies and percentage for qualitative data and (mean, and SD) calculation for quantitative data. Pearson's chi-square test and Fisher exact test were used to detect the relationship between continuous variables. A one-sided P value of 0.05 or less was considered statistically significant.

■ RESULTS

Basic characteristic of children

The frequent age group was (1–5 years) in 24 (42.1%), followed by group (6–10 years) in 19 (33.3%) of children. The mean age was 5.53±4.09 years with median of 5 years. Male

to female ratio was (1:1). Of 57 children, 26 (45.6%) were found to had speech plus other delayed types. Sitting delayed seen in 21 (36.8%), speech delayed only in 5 children, walking delayed in two children. Only three cases reported with convulsion. Two children had positive family history of DD. 12/57 children born as 1st baby, 9/57 as 2nd baby, 19/57 as 3rd baby, 4/57 as 4th baby and 13/57 as 5th baby. Regarding delivery of baby, 48 of children porn by normal vaginal delivery and 9 babies born by caesarian section. In relation to antenatal time, pregnancy pass normally in 39 (68.4%). However, 6 (10.5%) mothers had history of pregnancy induce hypertension, 8 (14.1%) with diabetes, 6 (10.5%) with vaginal bleeding, 3 (5.3%) with Oligohydramnios and one with Polyhydramnios. Regarding feeding, pure breast mode reported in 16 (28%), bottle feed in 27 (47.4%) and 14 (24.6%) were mixed feeding (Table 1).

Table 1
Basic characteristic of children in the study

Variables		**No.**	**%**
Age (years) Mean±SD (Median) = 5.53±4.09 (5)	<1	6	10.5
	1–5	24	42.1
	6–10	19	33.3
	>10	8	14.1
Gender	Male	29	50.9
	Female	28	49.1
Delayed	Speech	5	8.8
	Speech with other	26	45.6
	Walking	2	3.5
	Sitting	21	36.8
	Convulsion	3	5.3
Family history	Yes	2	3.5
	No	55	96.5
Order in the family	1st	12	21.1
	2nd	9	15.8
	3rd	19	33.3
	4th	4	7
	5th	13	22.8
Mode of delivery	Normal	48	84.2
	Caesarian section	9	15.8
Antenatal period of mother	Normal	39	68.4
	Hypertension	6	10.5
	Diabetes	8	14.1
	Polyhydramnios	1	1.8
	Oligohydramnios	3	5.3
	Vaginal bleeding	6	10.5
Feeding	Breast	16	28
	Bottle	27	47.4
	Mixed	14	24.6

Table 2
Percentage of DD clinically

Clinical	No.	%
Global developmental delay only	21	36.8
Specific developmental delay	33	57.9
Global developmental delay plus convulsions	3	5.3

Clinical findings

Global developmental delay (GDD) only discovered in 21 (36.8%), specific developmental delay (SDD) found in 33 (57.9%), and global developmental delay plus convulsions (GDDC) in three cases, with a significant difference (p=0.01) (Table 2).

Brain MRI findings

Normal brain MRIs were seen in 32 (56.1%) of cases whereas 25 (43.9%) were abnormal MRI findings (Fig. 1).

In relation Brain MRI, T1WI, T2WI, FLAIR, DWI and ADC map ± contrast were used. The results showed non-specific findings in 5 (8.8%), with high significant difference (p=0.006). The congenital and developmental abnormalities seen in 10 (17.5%) of children with high significant difference (p<0.0001). The detectable syndromes observed in one case. There was no traumatic and neurovascular diseases. The metabolic and degenerative diseases reported in 2 (3.5%) and neoplastic or non-neoplastic masses noticed in one case (Table 3).

In relation to brain structures, the percentage of brain MRI findings listed in Table 4. Ventricles were asymmetric in 9 (15.8%) of brain MRI, whereas normal observed in 48 (84.2%) of cases with highly statistical difference, (p<0.0001). Agenesis of corpus callosum seen in seven cases (12.3%) whereas normal callosum found in 50 (87.7%) with significant difference (0.001). Abnormal white matter observed in 7 (12.3%) while normal seen in 50 (87.7%), with highly statistical difference (p<0.0001). Abnormal grey matter observed in 3 (5.3%) while normal seen in 54 (94.7%), with a statistical significant difference (p=0.042). Cerebellum was atrophied in 3 (5.3%) while normal seen in 54 (94.7%), with a statistical significant difference, (p=0.02). Heterotropia in one case (1.8%, p=0.334). Mega cisterna magna observed in 17 (29.8%) of cases with a high significant difference (<0.0001).

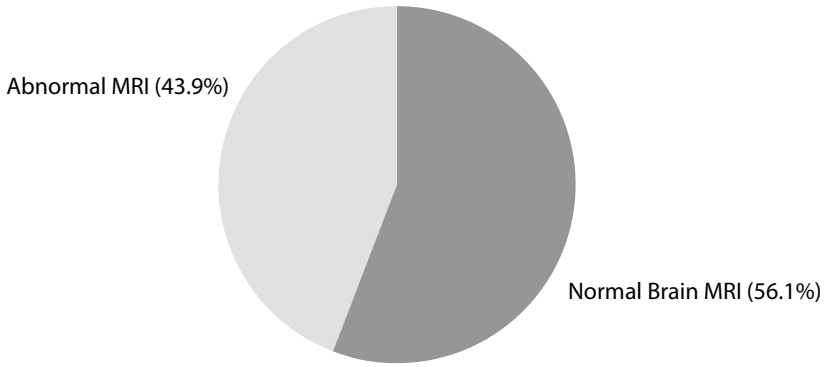

Fig. 1. Delayed development diagnosis clinically

Table 3
Percentage of Brain MRI findings

Brain MRI findings	Positive	Negative	p-value*
	No. (%)		
Non-specific findings	5 (8.8)	52 (91.2)	0.006
Congenital and developmental abnormalities	10 (17.5)	47 (82.5)	<0.0001
Detectable syndromes	1 (1.8)	56 (98.2)	0.333
Traumatic and neurovascular diseases	0	57 (100)	NA
Metabolic and degenerative diseases	2 (3.5)	55 (96.5)	0.129
Neoplastic or non- neoplastic masses	1 (1.8)	56 (98.2)	0.336

Note: * Fisher exact test.

Leukodystrophy observed in 15 (26.3%) of cases with a high significant difference (<0.0001). Brain atrophy observed in 10 (17.5%) of cases with a high significant difference (0.0001). Dandy-Walker malformation observed in 5 (8.8%) of cases with a significant difference (0.05). DENT and Porencephaly found two cases for each.

Table 4
Percentage of Brain structural MRI findings

Brain structures findings		No.	%	p-value*
Ventricles	Normal	48	84.2	<0.0001
	Asymmetric	9	15.8	
Corpus callosum	Normal	50	87.7	0.001
	Agenesis	7	12.3	
White matter	Normal	50	87.7	<0.0001
	Abnormal	7	12.3	
Grey matter	Normal	54	94.7	0.042
	Abnormal	3	5.3	
Cerebellum	Normal	54	94.7	0.02
	Atrophy	3	5.3	
Heterotropia	Yes	1	1.8	0.334
	No	56	98.2	
Mega cisterna magna	Yes	17	29.8	<0.0001
	No	40	70.2	
Leukodystrophy	Yes	15	26.3	<0.0001
	No	42	73.7	
Brain atrophy	Yes	10	17.5	0.0001
	No	47	82.5	
Dandy-Walker malformation	Yes	5	8.8	0.05
	No	52	91.2	
DENT	Yes	2	3.5	0.25
	No	55	96.5	
Porencephaly	Yes	2	3.5	0.27
	No	55	96.5	

Note: * Fisher exact test.

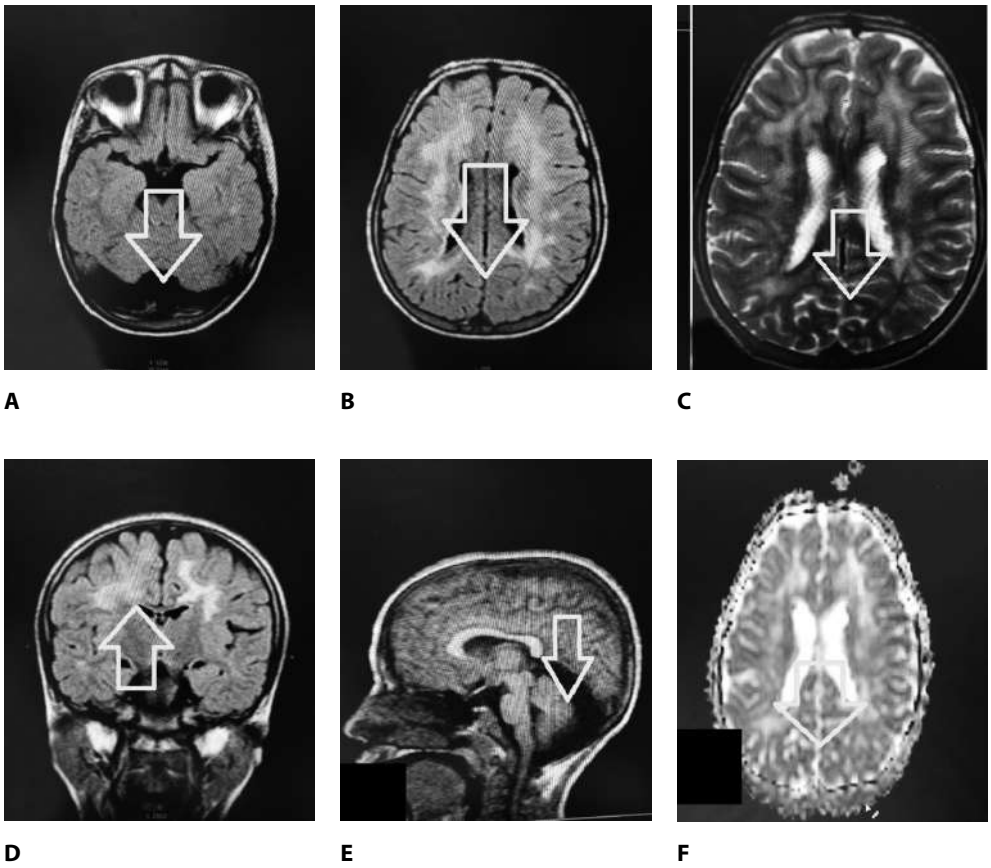

Fig. 2. 8-years-old boy with speech delay (Leukodystrophy: is genetic diseases that predominantly affect the white matter of the central nervous system): A. T1WI axial: isointense white matter lesion. B. FLAIR axial: deep white matter / bilateral periventricular hyper intensities. C. T2WI axial: bilateral periventricular deep white matter hyper intensities lesion. D. FLAIR coronal: hyper intensities deep white matter lesion. E. T1WI sagittal: isointense lesion. F. DW ADC map: non restricted diffusion deep white matter lesion

■ DISCUSSION

In the present study, totally 57 children brain MRI were studied. Their mean age was (5.53±4.09 years) with median of 5 years with male to female ratio was (1:1). These are dissimilar with Habibullah et al. [9], who studied 170 children (93 males and 77 females) aged between 3 months to 12 years. The mean age of similar to Momen et al. [10] but gender incidence was differ. Abhishek and Bhautik Kapadia studied 200 children aged from birth to 12 years (115 males and 85 females), the most age group detected with DD was 3–7 years (47.5%) which is greater than our finding and found no gender significant difference was observed among brain MRI normality [11].

In the current study, 26 (45.6%) were complained of speech plus other delayed types. Sitting delayed seen in (40.4%), speech delayed only in 5 children, walking delayed in

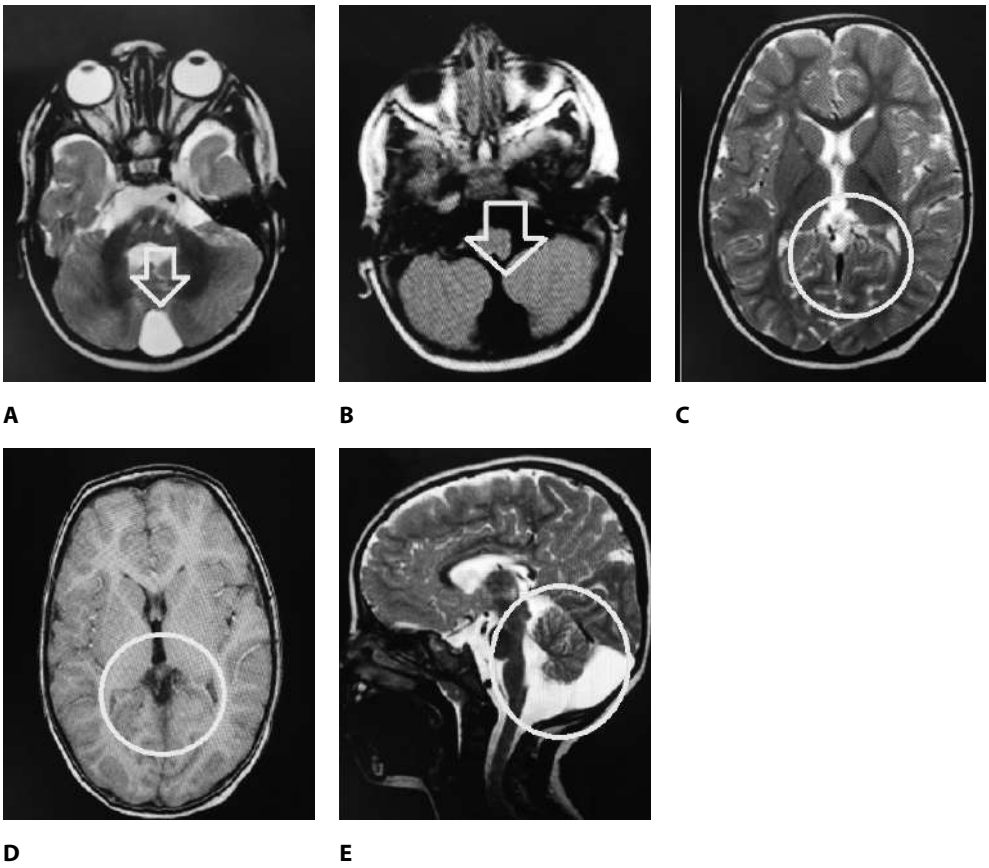

Fig. 3. 28 months new baby (Mega cisterna magna): A. T2WI axial: large retro-cerebellar space that follow the CSF signal intensity and no vermis anomaly. B. FLAIR axial: large retro-cerebellar CSF space with fluid signal drop. C. T2WI axial: normal white and gray matter with normal lateral and 3rd ventricles. D. T1 axial: normal gray and white matter and ventricular system. E. T2WI sagittal: enlargement of CSF fluid in posterior fossa and seen in communication of rest of subarachnoid spaces

two children. Only three case reported with convulsion. Two children had positive family history of DD. Regarding delivery of baby, 48 of children porn by NVD and 9 babies born by CS. Randhawa et al. [1] found more children were born by NVD rather than CS, but no significant difference was seen between the two groups. Nevertheless, some authors suggested that a planned CS carried a risk of birth complications [1].

In relation to antenatal time, pregnancy pass normally in 39 (68.4%). However, 6 (10.5%) mothers had history of pregnancy induce hypertension, 8 (14.1%) with diabetes, 6 (10.5%) with VB, 3 (5.3%) with oligohydramnios and one with polyhydramnios. Regarding feeding, pure breast mode reported in 16 (28%), bottle feed in 27 (47.4%) and 14 (24.6%) were mixed feeding. Similar was noted in the study performed by Widjaja et al. [8], Dasan et al. [12] and Al-Naddaw et al. [13]. These are differ from findings of study by Chaudhary et al. [14], ere were (39.42%) cases with isolated DD whereas (60.58%) had DD with seizures and neurological deficit. They found that (67.3%) seizures, (40.38%) neurological defects,

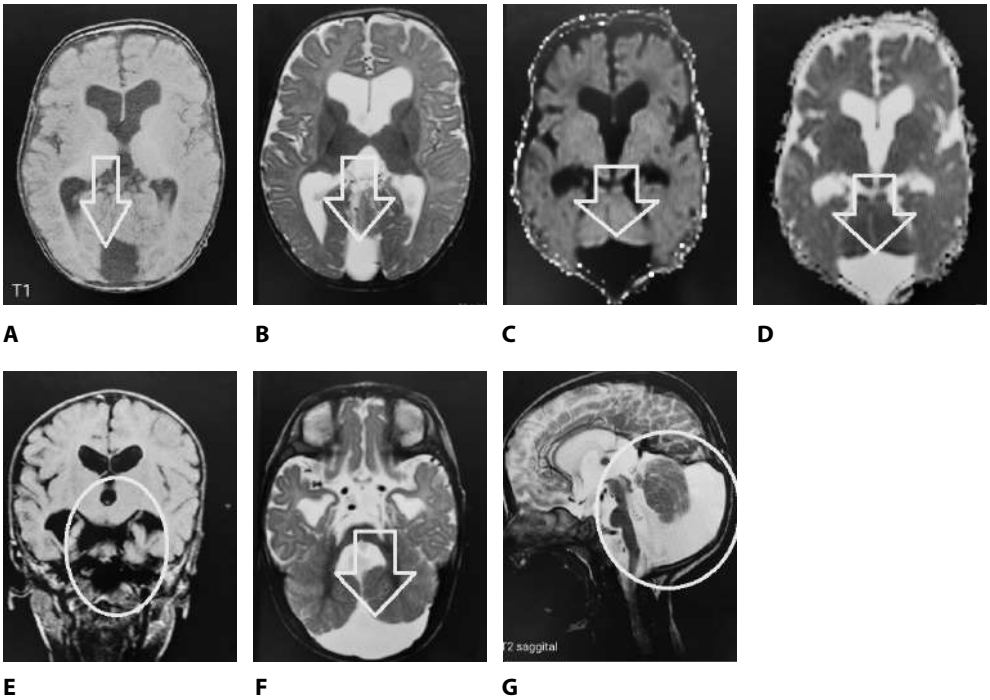

Fig. 4. 8 months new baby (Dendy) Walker malformation: is a posterior fossa anomaly characterized by agenesis or hypoplasia of the vermis and cystic enlargement of the fourth ventricle causing upward displacement of tentorium and torcula): A. T1WI axial: Large posterior fossa cystic space continue with the 4th ventricle, hypoplastic vermis. B. T2WI axial: Large posterior fossa cystic CSF spaces continue with 4th ventricle, obstructive hydrocephalus, hypoplasia of vermis. C. DWI: free diffusion. D. ADC map. E. FLAIR coronal: signal drop of CSF spaces. F. T2 axial: large posterior fossa cystic CSF spaces continue with 4th ventricle, obstructive hydrocephalus, hypoplasia of vermis. G. T2WI sagittal: abnormally high tentorium by cystic enlargement of posterior fossa

(30.77%) motor delay, (20.19%) speech delay and (9.62%) emotional delay and cognitive impairment. Ali et al. [5] reported isolated DD in 8 cases and DD plus other clinical features seen in 73 cases.

In this study, the global developmental delay (GDD) discovered in 21(36.8%), specific developmental delay (SDD) found in 33 (57.9%), and global developmental delay plus convulsions (GDDC) in three cases, with a significant difference (p=0.01). A disagree with Randhawa et al. [1] who reported most of children were diagnosed with GDD followed by GDDC. Al-Naddaw et al. [13], showed the same findings regarding GDD in Baghdad city. Randhawa et al. [1] suggested that perinatal hypoxic insult is more commonly associated with convulsion.

Chaudhary and co-authors studied 104 cases, the M:F ratio was 1.2:1, the age ranged from 3 months to 15 years and preterm babies found to be 65.38% [14]. Palve et al. [4], Ali et al. [5], Jauhari et al. [15] and Shevell et al. [16] said males were slightly more in number than the females, to be presented with DD but no considerable difference recorded. Statistically, normal and abnormal brain MRI findings were not influencing by gender, age groups and mode of delivery [1].

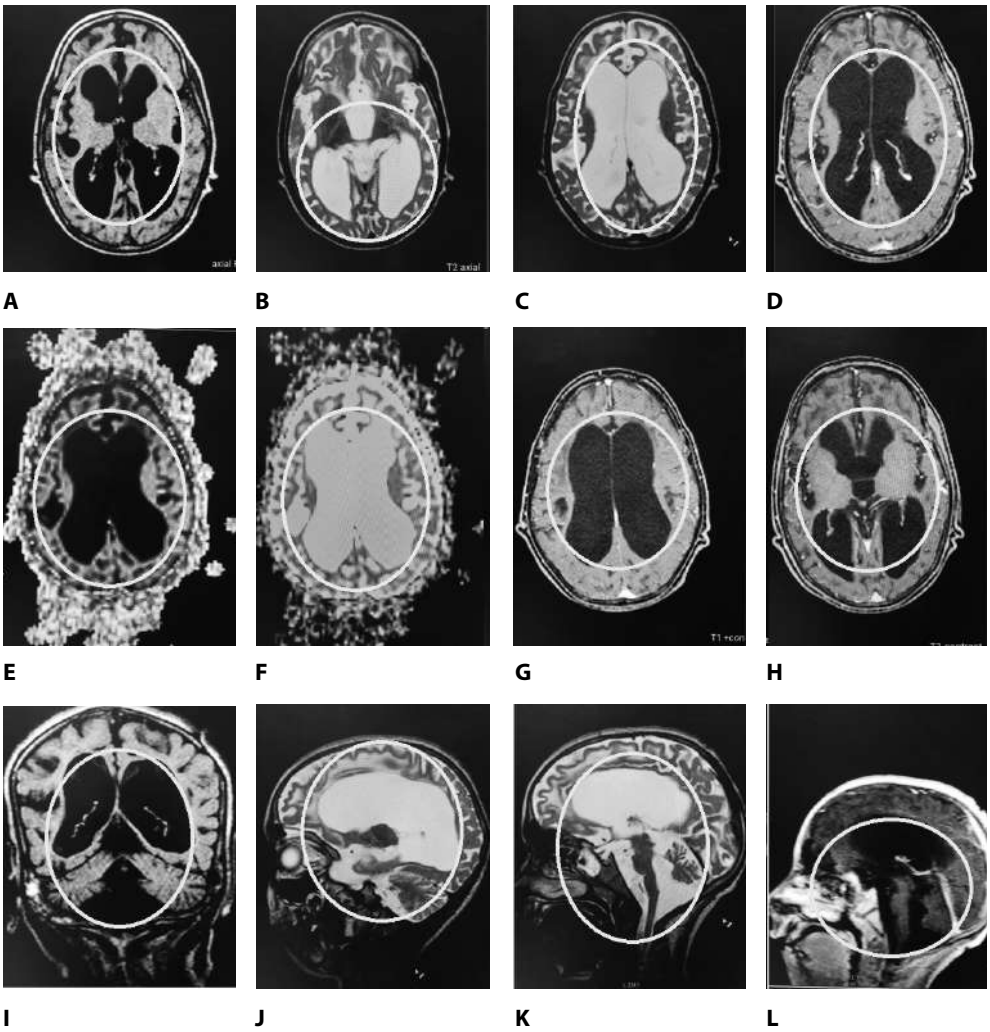

Fig. 5. 7-years-old girl, this is agenesis of the corpus callosum: A. FLAIR axial: hydrocephalus racing car sign (CSF fluid signal drop). B. T2WI axial: hydrocephalous racing car sign (CSF fluid SI). C. T2WI axial: dilated lateral ventricles. D. T1 axial + contrast: normal parenchymal enhancement (no enhancing lesion). E. DWI: free diffusion. F. ADC map: free diffusion. G. T1 axial + contrast: normal enhancing parenchyma (no mass). H. T1 axial + contrast: normal enhancing parenchyma (no mass). I. T1 coronal + contrast: normal enhancing brain parenchyma (no enhancing mass)

Our finding revealed normal brain MRIs were seen in 32 (56.1%) of cases whereas 25 (43.9%) were abnormal MRI findings. This is disagree with Habibullah et al. [9], found normal MRI in 45.3% while abnormal MRI reported in 54.7%. A high percentage of abnormal MRI images are reported by Momen et al. [10] (58.6%), Shevell et al. [17] (65.5%), Pandey et al. [18] (63.8%), Koul et al. [6] (71.8%), Battaglia et al. [19] (80.8%), and Widjaja et al. [8] (84%). These wide ranges could be due to differences in inclusion criteria, developmental in MRI modalities and children from different population groups. Also, a dislike with Chaudhary

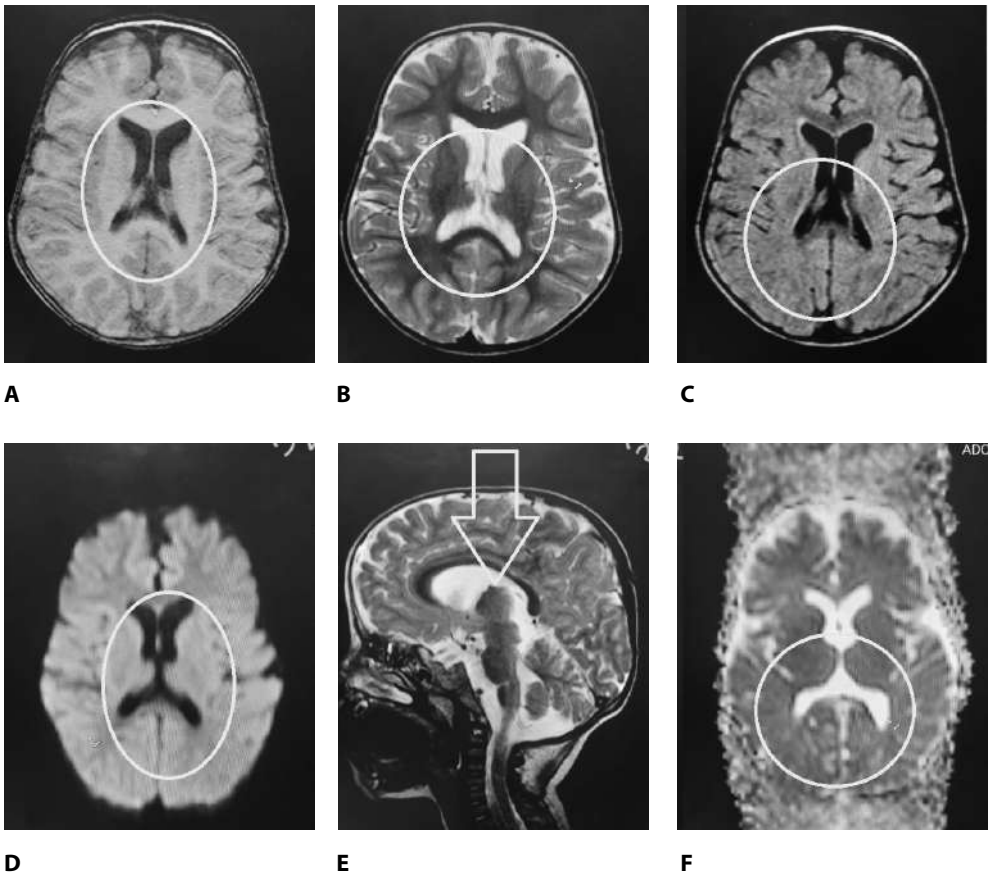

Fig. 6. 4-years-old boy (Brain atrophy): A. T1WI axial. B. T2WI axial. C. T2-FLAIR: show mild dilated lateral ventricles with prominent. frontal and temporal sulci. D. DW: free diffusion. E. T2 sagittal: mild dilated CSF spaces. F. ADC map: normal diffusion

and co-authors [14], reported (39.42%) cases had normal MRI images whereas (60.58%) had abnormal images. Randhawa et al. [1] reported high prevalence of abnormal brain MRI findings (80%) dissimilar our data.

Abhishek and Bhautik Kapadia [11] reported (72.5%) of cases had abnormal MRI images and (27.5%) has normal MRI and abnormal findings were more common with convulsions. The developmental and congenital anomalies have distinctive radiological results, and their detection are very important and helpful in management, parents counseling and diagnosis [20].

In regard to Brain MRI sequences, we used T1WI, T2WI, FLAIR, DWI and ADC map ± contrast. Also, Habibullah et al. [9] used several sequences were: axial T1TSE, T2TSE, T2 FLAIR, EP2D diffusion, T2TIRM, and PDTSE; coronal T1TIR and T2TSE; and sagittal T1TSE. Chaudhary et al. [14], stated that use of contrast is ineffective, since MRI with contrast indication are tumors, brain injury, and vascular brain lesion. We see enhancement region

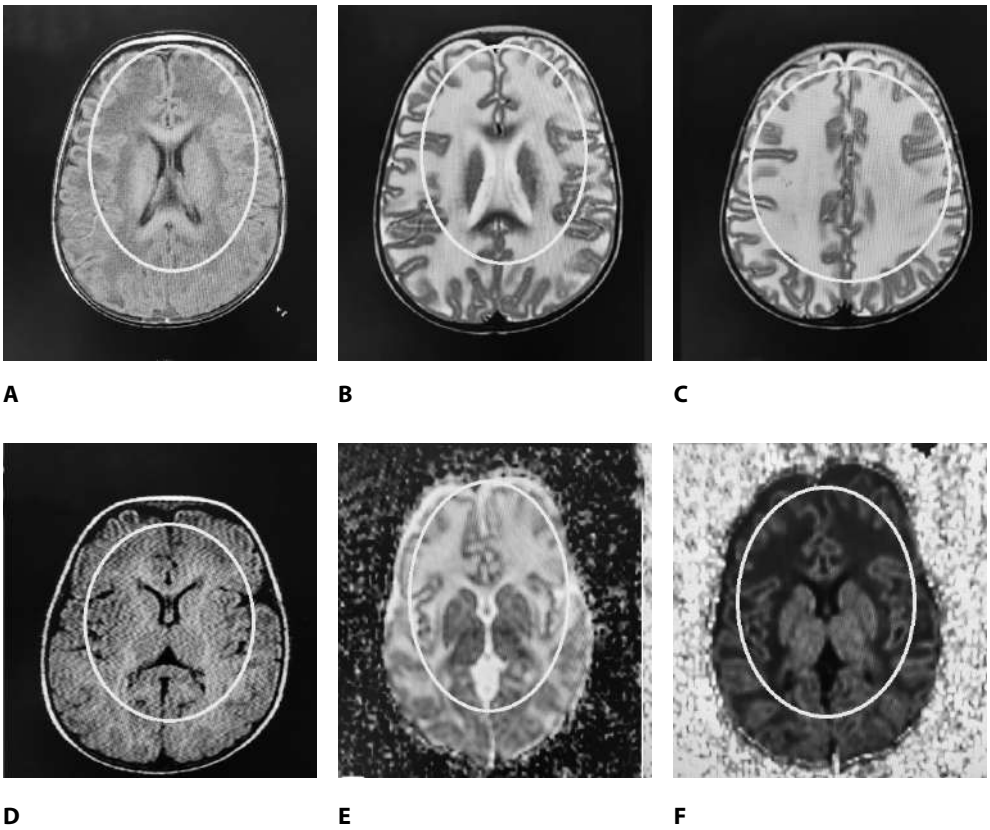

Fig. 7. 20 months girl (Canavan disease: a neurological disorder in which the brain degenerates into spongy tissue full of small fluid-filled spaces): A. T1 axial: bilateral diffuse periventricular hypo intensities. B. T2WI axial and C. FLAIR show: bilateral diffuse periventricular and subcortical, fibers hyperintense lesion. D. DWI: no diffusion restriction. F. ADC map: no restriction diffusion

as homogenous or heterogenous. Authors reported that Gadolinium contrast does not give good data in children with DD [21]. Randhawa et al. [1] used Axial T1 and T2, GRE, DWI (with ADC), Axial T1 and T2 FLAIR, sagittal T1, and coronal T2.

Our results showed non-specific findings in (8.8%), the congenital and developmental abnormalities in (17.5%), the detectable syndromes in one case, no traumatic and neurovascular diseases, the metabolic and degenerative diseases in 2 (3.5%) and neoplastic or non-neoplastic masses in one case. These differ from Abhishek and Bhautik Kapadia [11], the most common DD was neurovascular insult to the brain found in (29.5%) cases. MRI findings were encephalo-malacia in (30.5%), atrophy with dilatation of ventricles in (45.76%), corpus callosum thinning in (5%) and gliosis in (6.7%). They found structural malformation in 42 cases included Chiari-II (19%), dandy walker malformation (14.2%), and microcephaly (12%). Furthermore, they recorded infective and inflammatory causes (17%) like meningitis, tuberculosis and post-acute encephalopathy or encephalitis. Also, they reported metabolic etiologies as a drenolueco-dystrophy, hyper-bilirubinemia

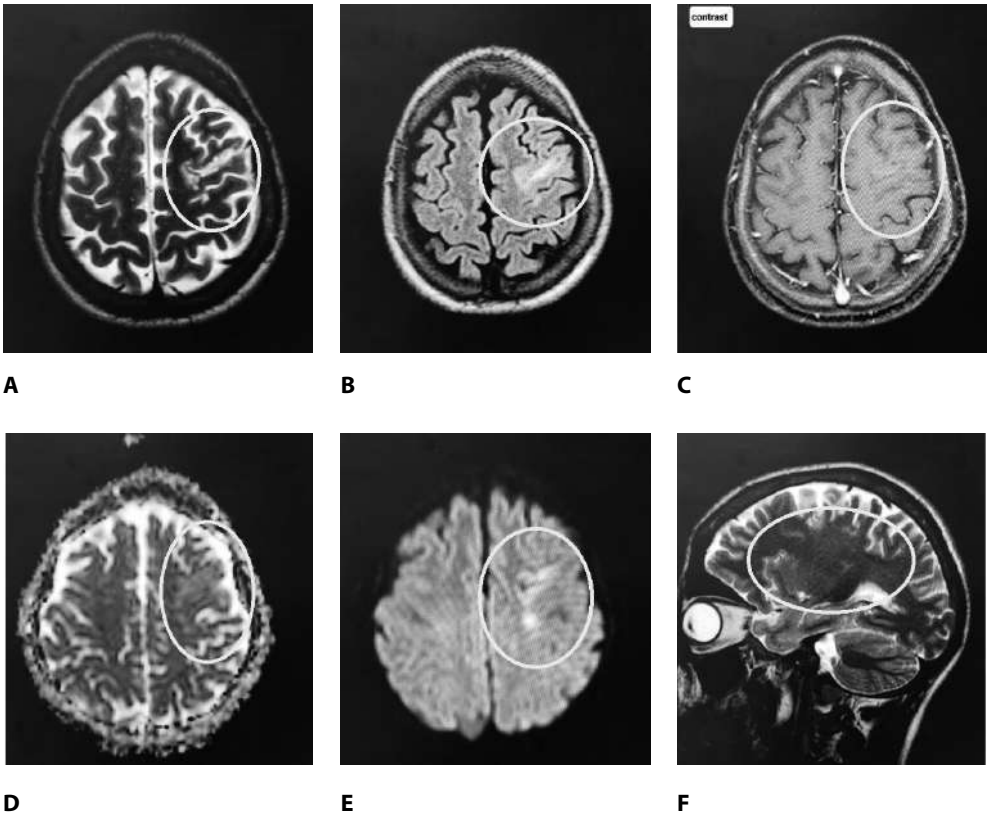

Fig. 8. 15-years-old young boy: Dysembryoplastic neuroepithelial tumor (DNET): is a low-grade, slow-growing brain tumor: A. T2WI axial: Left posterior frontal cortical and subcortical high signal lesion with bubbly appearance. B. FLAIR axial: Left posterior frontal cortical and subcortical partially suppressed high signal lesion with bubbly appearance. C. T1 axial + GD contrast: mild heterogenous enhancement. D. ADC: Non significant. E. DWI: Non significant. F. T2WI sagittal: Cortical / subcortical bubbly high SI lesion

and dys-myelination. In addition, neoplastic causes were cranio-pharyngioma (2 cases), glioma (1 case), ependymoma (1 case) and brain metastasis (1 case).

Authors concluded that most cases were clinically diagnosed with GDD followed by the GDDC, and only three patients had SDD, with no significant difference was noted [1]. However, a study by Schaefer et al. recorded that the yield of abnormal finding was higher when convulsions is present along with GDD [22].

Chaudhary et al. [14], observed the percentage of the etiology of DD were (39.42%), (29.81%), (23.08%), (5.77%) and (1.92%) cases as normal, traumatic/neurovascular, congenital/developmental, metabolic/degenerative and non-specific, respectively.

In the present study, ventricles were asymmetric in (15.8%) of brain MRI. Agenesis of corpus callosum seen in one case. Abnormal white matter observed in (12.3%). Abnormal grey matter observed in (5.3%). Cerebellum was atrophied in (5.3%). Heterotropia, mega cisterna magna and leukodystrophy were recorded in (1 case), (5 cases) and (7 cases).

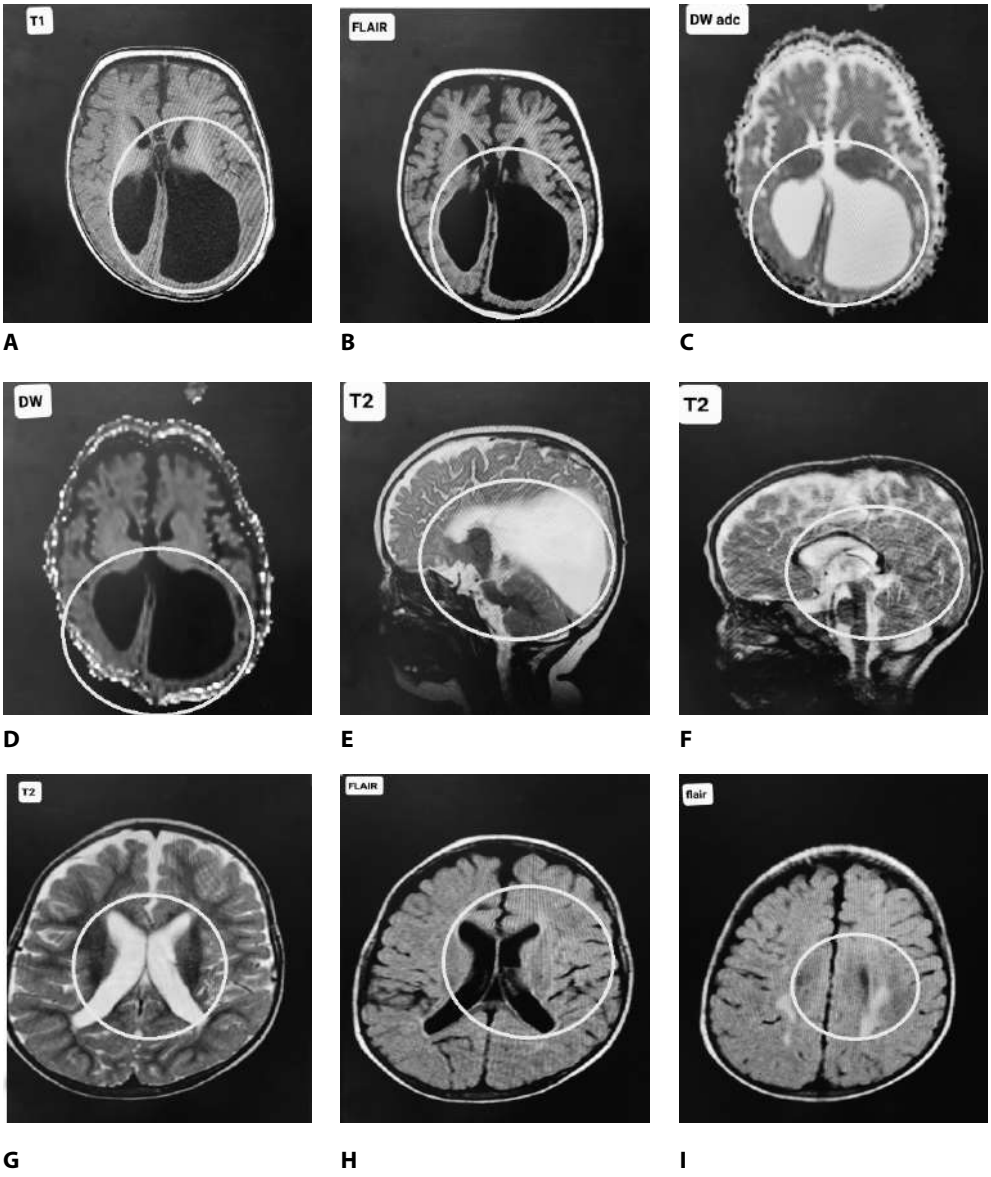

Fig. 9. 8 months female (Corpus callosum agenesis and cerebral atrophy): A. T1WI axial and B. FLAIR axial: hugely dilated posterior horns of lateral ventricles mostly left side. C. ADC: (DW): normal diffusion. D. DWI: normal diffusion. E. T2WI: sagittal severe colpocepahly. F. T2WI sagittal: absence of corpus callosum. G. T2WI axial: dilated lateral ventricles with prominent sulci. H. FLAIR axial: fluid signal drop

Abnormalities of ventricles and white matter were the most common structural MRI findings [13]. Chaudhary et al. [14], distributed MRI finding based on structural morphology, there were (47.12%), (41.35%), (28.85%), (10.58%), (7.69%) and (2.88%) patients with abnormal results in ventricles, corpus callosum, white matter, grey matter, cerebellum,

and brainstem respectively. Chaudhary et al. [14], reported one case with Dandy-Walker malformation and two cases of leukodystrophy and agenesis of cerebellum in one case.

Older children are more liable to diagnosed with DD because of parents are unwary about features of DD, most parents unwell educated, low level of socioeconomic status, crowded family members, lack of sophisticated facilities and care programs; therefore, they are detected and investigated later [23–25].

■ CONCLUSION

The brain MRI very important in detection of DD in pediatric age groups. Early and easily diagnosis of DD by brain MRI is one of option in the management of these etiologic and pathophysiologic conditions in Iraq. Speech and sitting delay represent the major of DD.

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