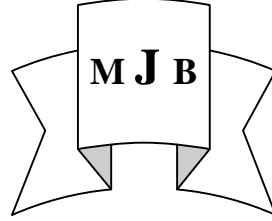


The Findings of Brain Computed Tomography in Neonatal Seizure

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Abstract

Background: Seizure is the commonest neurological manifestation in the neonatal period, and usually it shows an underlying problem in the brain due to brain damage and developmental defect in the central nervous system. As CT(computed tomography) scan is more reliable, more sensitive and more specific in determining underlying brain lesion that cause seizure like ischemia, hemorrhage and brain structural dysgenesis, so it became an important tool in assessment of neonatal convulsion.

Aim of study : To find abnormality in CT scan which are the possible causes for neonatal convulsion .

Patients and methods :A descriptive study ,performed for 70 neonates referred for CT scan of the head from period of the first of the January 2008 to the first of April in 2010 in AL-Diawanyia teaching hospital in Iraq after good history information, clinical examination and paraclinical investigation. All informations are collected in check list, including time of occurring seizure & underlying causes. CT scan(Siemens) used is with multiple axial sections, after general anesthesia to the neonate .

Results :From 70 neonates with neonatal seizures 28 were female and 42(60%) were male, 39 neonates have normal CT scan and 31 have abnormal CT scan such as brain dysgenesis, intracranial hemorrhage, brain ischemia and cerebrites.

Conclusion :High incidence of abnormal CT scan (87.5%) in seizure occurring during the first 72hours. Among those positive CT scan of brain hypoxic ischemic was found in (45.9%) .

مشاهدات المفراس الحلزوني في اختلاجات حديثي الولادة

الخلاصة

خلفية الدراسة: الاختلاجات العصبية هي أهم الأمراض العصبية التي تصيب حديثي الولادة وعادة تحدث نتيجة لوجود خلل في الجهاز العصبي المركزي ويعتبر المفراس الحلزوني أكثر حساسية في معرفة أسباب هذه الاختلاجات مثل الجلطة الدماغية او النزف الدماغي او أي خلل تركيب في الدماغ .

هدف الدراسة: تحديد مشاهدات المفراس الحلزوني للدماغ لمعرفة الأسباب المحتملة للاختلاجات العصبية في حديثي الولادة .
المرضى والطرق: تضمنت الدراسة مريض من 70 حديثي الولادة مصابون بالاختلاجات العصبية أحيلوا من مستشفى الولادة والأطفال التعليمي في الديوانية إلى الفحص بالمفراس الحلزوني للفترة من الأول من كانون الثاني 2008 إلى الأول من نيسان 2010 بعد إجراء الفحوصات السريرية وتدوين تاريخ وسبب المرض .

تم فحص جميع حديثي الولادة بالمفراس الحلزوني باخذ مقاطع محوريه بعد تخدير حديث الولادة تخدير عام .
النتائج: من السبعون حديثي الولادة 40% أنثى و60% ذكر . 39 حديثي الولادة كانت نتائج المفراس الحلزوني طبيعية في 31 منهم كانت النتائج غير طبيعية مثل النزف الدماغي ,خلل تركيب في الدماغ ,الجلطة الدماغية.الاختناق الولادي.

الاستنتاجات

الأكثر المرضى اللذين كان لديهم نتائج مفراس غير طبيعية لديهم اختلاجات عصبية خلال الأيام الثلاثة الأولى 87.5% ونسبة عالية منهم 45.9% كان لديهم جلطة الدماغ الناتجة عن الاختناق الولادي.

Introduction

Seizure is the commonest neurological manifestation in the neonatal period (the first 28 days of life), it can define as paroxysmal alternation in neurological function e.g. behavioral, motor, or autonomic function and usually it shows an underlying problem in the brain due to brain damage and developmental defect in the central nervous system[1-5].

Among the abnormal neurological signs, neonatal seizure have a particularly poor prognosis[6-8]. Early onset of seizures is a strong predictor of later morbidity and mortality in infant. Neonates are at particular risk for the development of seizure, because metabolic, toxic, structural and infections disease manifest more during this time, than any other period of life. Sometime neonatal seizure caused by treatable disorders that if not diagnosed, can cause permanent brain damage. Neonatal convulsion are dissimilar from those in a child and adult because generalized tonic-clonic convulsions tend not to occur in the first month of life [9,10].

The most common causes of neonatal seizure in first 1-3days of life is: hypoxic ischemic encephalopathy, intraventricular hemorrhage, hypocalcaemia, hypoglycemia and inborn error of metabolism. While in neonates with age group 4-14 days the common causes of seizure are infection, metabolic disorders and kernicterus. In neonate between 2-8week the causes of convulsion tend to be infection, head injury and malformation of cortical development [10].

The work up in the management of neonatal seizure should include a careful prenatal and natal history as well as complete physical examination and

laboratory studies which is should include blood glucose, blood bilirubin ,electrolytes, calcium, phosphate and magnesium are the next step .If there is any suspicion of infection, a spinal tap should be done to rule out meningitis .Neuroimiging studies (cranial ultrasound, CT scan or magnetic resonance imaging (MRI)) are mandatory to help us in the diagnosis of ischemic, hemorrhagic changes and brain dysgenesis which were observed in high frequency in neonates with seizure[5,11]. .Additional studies, include blood level for ammonia, lactate, pyrovate and urine studies for organic and aminoacid analysis for possible inborn error of metabolism. Serial EEG-polygraphy can document persistent of seizure [12, 13].

Among the radiological investigations magnetic resonance imaging and CT scan are commonly used to screen neonatal intracranial lesions and both of them have significant advantages over sonography for diagnosing causes of convulsion [14].

As CT scan is more reliable more sensitive and more specific and even its better than US in determine underlying brain lesion that cause seizure like ischemia, hemorrhage and brain structural dysgenesis, so it became an important tool in The assessment of neonatal convulsion [15-18].

MRI seem to be more sensitive than CT scan for detection of subtle brain injuries & it plays an important role in the work up of brain pathology, it has advantages over CT scan (no expos to ionizing radiation & provides better brain morphological assessment). New generations of MRI (included diffusion weighted images & perfusion weighted images) has made it possible to perform

dynamic & functional analysis of cerebral circulation) & this lead to increase its usefulness in diagnosing acute brain ischemic changes. The major drawback of MRI is the unavailability of MR-scanner, high cost, long examination time and difficult interpretation [19-24].

Aim of study

To find abnormality in CT scan which are the possible causes for neonatal convulsion.

Patients and Methods

A descriptive study, performed for 70 neonates referred for CT scan of the head from period of the first of the January 2008 to the first of April in 2010.

Those neonates were referred for CT scan from the neonatal intensive care unit or from pediatric outpatient clinic in the maternity and children teaching hospital in AL-Diawanyia in Iraq after good history information, clinical examination and investigation, all information are collected in check list, included neonatal demography (age, sex, maturity index, referring complaint time of onset of seizure, the possible underlying causes).

The patients included in this study are the neonates who had convulsion diagnosed by a pediatrician during the first twenty eight days of life and cranial CT scan done for them.

Neonates excluded from this study if have convulsion but CT scan was not done because the family refused to do CT scan or when there is contraindication for anesthesia .

CT scan(Siemens. Emotion 4, VA47C) with multiple axial sections, slice thickness 3mm,(kv 130. Ms 30) without contrast after general anesthesia to the neonate using minimum dose of fluthane inhalation by Penlon anesthetic machine with about 1 MAC(minimal alveolar concentration) . Statistical analysis used in this study include frequency, percentage, incidence of abnormal brain CT in the first three days of life, and incidence of ischemic hypoxic encephalopathy in neonate with positive CT scan findings .

Results

The total number of patients involved in this study was 70, among them 42 was male (60%) and 28 female (40%) .As show in figure 1.

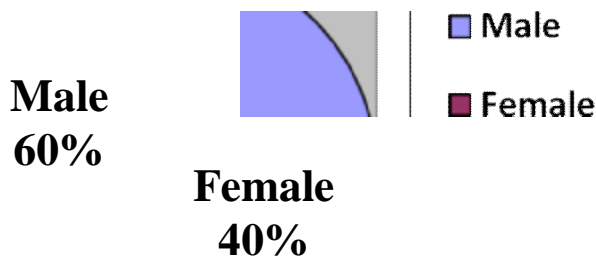


Figure 1 Distribution of neonate according to the sex

The mode of delivery in 45 neonates was normal vaginal delivery (64.3%) and in 25 neonates was cesarean section (35.7%). The majority of neonates were term 53 (75.7%) and only 17 were preterm infant(24.3%).

Thirty nine neonates have normal CT scan and 31 have abnormal CT scan (Table – 1). The CT abnormality were brain dysgenesis, intracranial hemorrhage, brain ischemia and cerebritis. The majority of neonatal

seizures with positive CT findings occur during first three days of life 21(30.2%) followed by 6(8.8%) and 4(5.2%) during the next 4-14days and 2-4weeks respectively. Intracranial hemorrhage occur in 5 patients and all of them have seizure during 1st three day of life. Hypoxic ischemic encephalopathy found in 15neonate, eleven of them have seizure during 1st three days and only one neonate have intracranial cerebritis .

Table 1 Distribution of the CT findings according to the neonatal age at time of convulsion onset.

CT scan findings	Abnormal CT scan					Normal CT scan	Total
	Brain dysgenesis No. (%)	Intracranial hemorrhage No.(%)	Hypoxia Ischemic encephalopathy No.(%)	cerebrities No.(%)	total no of the neonate with abnormal CT scan No. (%)		
-3 days	5(7.2%)	5(7.2%)	11(15.8%)		21(30.2%)	3(4.1%)	24(34.2%)
4-14 days	2(2.9%)		4(5.9%)		6(8.8%)	18(26%)	24(34.2%)
2-4weeks	3(3.9%)			1(1.3%)	4(5.2%)	18(25.7%)	22(31.6%)
Total	10(14%)	5(7.2%)	15(21.7%)	1(1.3%)	31(44.2%)	39(55.8%)	70(100)

Intracranial hemorrhage found in 5 patients and 4 of them are preterm neonates
 Hypoxic ischemic encephalopathy found in 15 patients and only 3 of them are preterm babies.

Three out five patients with intracranial hemorrhage have normal vaginal delivery and 11 neonates out of 15 with hypoxic ischemic encephalopathy had normal vaginal delivery.

Table 2 Distribution of the CT findings in neonatal convulsion occur during first three days of life .

CT findings	Type of abnormal CT findings	No. %	Total
abnormal CT findings	Brain dysgenesis	5(20.8%)	21(87.5%)
	Intracranial hemorrhage	5(20.8%)	
	Hypoxic ischemic encephalopathy	11(45.9%)	
Normal CT finding		3(12.5%)	3(12%)
Total		24(100%)	24(100)

From table -2- we found high incidence of abnormal CT scan (87.5%) in seizure occurring during the first 72hours. Among those abnormal CT findings found high incidence of hypoxic ischemic encephalopathy (48.34%). The frequency of structural brain abnormalities (brain dysgenesis) observed in 10 neonates (32.3%) as

shown in Table -3- large cistern magna was observed in 3 neonates, schizencephaly in one patient, hydrocephaly in 2 neonates ,large cavum septum pellucidum in one neonate, porencephaly in 2 patients and arteriovenous malformation in 1 neonate.

Table 3 Types of structural brain abnormalities in 10 neonates.

Type of brain abnormalities	neonates	
	No.	%
Large cistern magna	3	9.7
Schizencephaly	1	3.2
Hydrocephaly	2	6.5
Large cavum septum pellucidum	1	3.2
Porencephaly	2	6.5
Arteriovenous malformation	1	3.2
Total	10	32.3

Figure -2-Shows the etiology of seizure in neonates with normal CT scan kernicterus found in 8 neonates (20.5%), metabolic disorders in 6 patients (15.4%), (four patients had

hypoglycemia & other two patients had hypocalcaemia), meningitis in 10 neonate (25.7%) and unknown causes in 15 neonates (38.5%) .

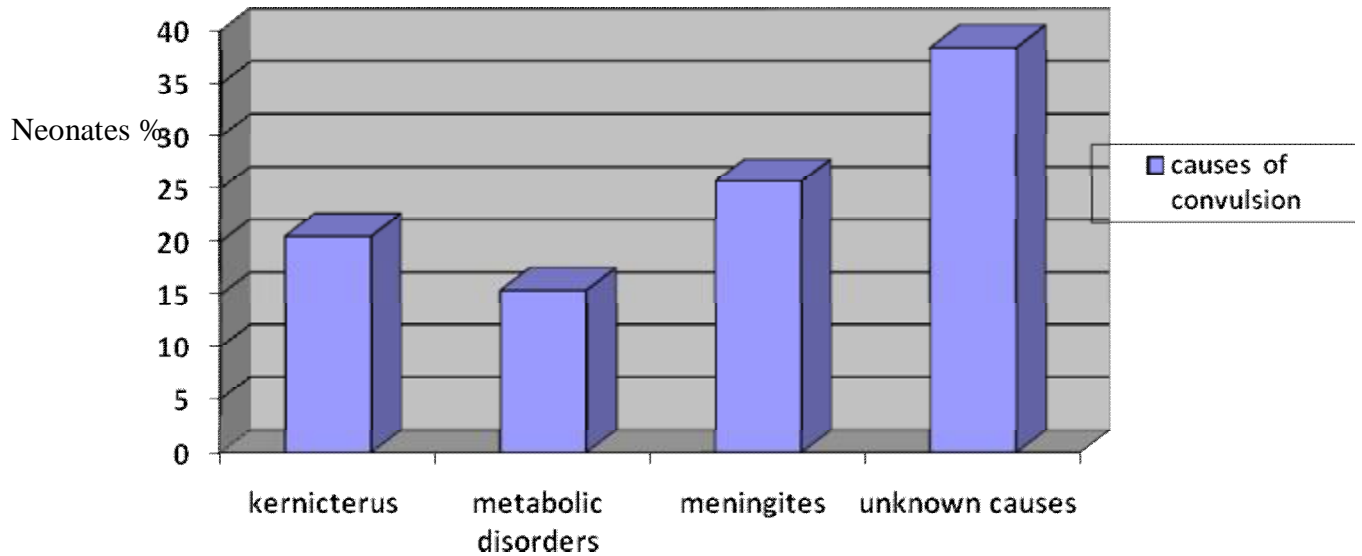


Figure 2 Causes of neonatal seizure in neonates with normal CT scan of the head .

Discussion

Seizure is the most frequent sign of neurological dysfunction in the neonate most neonatal seizure occur between 12 and 48 hours of life and its not only more frequent in neonatal period but also very difficult to diagnosis because of subtle nature [25,26]. The most common cause of neonatal seizure is hypoxic –ischemic encephalopathy (60%), many additional disorders are likely to cause seizure including intracranial hemorrhage(15%), metabolic, infectious, traumatic, structural, and maternal disturbances [14,10].

In this study there is an overall male preponderance (60%) which is consistent and support with other studies Moayedi et al[27], Taghdiri et al[28] and Sanjeev et al[29] who also reported male sex preponderance in their studies for which no plausible mechanism has been proposed, Moayedi et al [27]reported a significant relationship between occurrence of seizure and sex (p 0.05),Taghdiri et al [28]found (65%) of neonate were male, while Sanjeev et

al[29] found (70.5%) were male and Sanjeev et al believe that male babies are cared better by their parents and are brought to the hospital even with minor complains but female babies are usually neglected and are managed at home even if they are very sick. This can be one factor in causing male sex preponderance.

Majority of neonates were term(75.7%) and majority of them a product of normal vaginal delivery (64.3%)which is also go with Sanjeev et al and Moayedi et al findings ,Sanjeev et al reported (82.3%) of cases were term and Moayedi et al report (65.6%)of cases were product of normal vaginal delivery and (73.6%) were term neonate.[28,29]. In this study we can explain this findings by most common causes of neonatal convulsion were postnatal complications.

Thirty nine neonates(55.8%) had normal CT scan of the head and other thirty one (44.2%) neonates have positive CT scan findings .This is in contrast to findings of Taghdiri et al[28] who found that 35% of neonate had normal CT finding

and 65% had abnormal findings, our findings can be explained that majority of postnatal complications which are the most common causes of seizure in our study do not show structural brain changes until it has certain complication or it became late stages [30, 31].

We found that the majority of neonates with positive CT findings had seizure occurring in the first three days of life which is also consistent with the findings of Taghdiri et al [28] who report that there is a high incidence of abnormal CT scan (65%) in seizures occurring during the first 72 hours, also this finding goes with Sanjeef et al [29] who found high incidence of abnormal CT scan (67.6%) in neonates having convulsion during the 1st 72 hours of life and goes with findings of Erikson et al [32] who reported that highest incidence of positive CT findings occur in the 1st and 2nd days of life. In our study, we can explain this by that early convulsions may be caused by prematurity, asphyxia and difficult labours which gives positive CT findings [30] this explanation is in line with Maharban S [33] who found that birth asphyxia and intracranial hemorrhage are together account for about half of early onset seizures followed by other causes. Also this explanation goes with Tekgul et al [34] who reported that cerebral hypoxia and difficult labor are the most common causes of early neonatal convulsions. Among those neonates who presented with abnormal CT scan, hypoxic ischemic encephalopathy seen in (45.9%), which goes with Renon et al study (40%) [35] & Arpino et al study [36].

Conclusions

High incidence of abnormal brain CT scan finding (87.5%) in neonatal seizure occurring during the first 72 hours after birth, high incidence of hypoxic ischemic encephalopathy in neonatal convulsions during first three days of life (45.9%) which occurs in the preterm and prolonged, difficult labour,

Recommendation

CT scan is highly recommended in neonatal seizure occurring during the first 72 hours after birth. Improvement of obstetrical access and proper intrapartum care should be considered in advance.

Although MRI detected a remarkably high incidence of brain lesions in neonatal seizures such as hypoxia and or haemodynamic causes but unfortunately that MRI is not available in our city at present time. A further study using MRI is worthwhile.

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