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Original Article

Incidental findings on cranial CT scans of children with head trauma

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Abstract

Aim: The aim of our study was to determine the prevalence of incidental findings in healthy pediatric age group who were taken to CT for head trauma.

Material and Methods: Cranial CT of 980 pediatric patients who were presented to the emergency department of our hospital due to brain trauma were retrospectively reviewed. All cranial CT scans were interpreted by a faculty radiologists and a neurosurgeon. All traumatic and non-traumatic CT findings were identified and entered into two seperate databases.

Results: Nine hundered eighty head-injured children who received cranial CT scans in the ED were evaluated. According to exclusion criteria, 146 of all were eliminated from the study. Of all remaining 834 patients, total of 86 patients (% 10.3) had IF on their CT scans. The 86 patients with incidental findings had a median age of 6.8 years (1 week –17.4 years old). Intracranial calcification was the most common incidental lesion in 14 patients (1.6%) while the least frequent one was the open lip schizencephaly in 2 patients (% 0.23). Malignant lesions such as astrocytoma-diffuse glioma in 4 patients (0.47%) and potentially life-threating lesions like arterio-venous malformation in 2 patients (0.23%) were also detected.

Conclusion: In pediatric age group who have long life expectancy, medicolegally and ethically it is important to determine incidental findings and specify them at radiological reports. It is necessary to disclose the incidental findings to the patients and families in an appropriate manner in order to decrease anxiety.

Keywords: Tomography; incidental finding; head trauma.

INTRODUCTION

Pediatric head trauma is one of the leading health problems of countries, regardless of the level of socioeconomic development. It is a frequent cause for emergency department (ED) appeal and is an important cause of mortality and morbidity in childhood. Computed tomography (CT) is the most effective and rapid diagnostic method for detecting traumatic brain injury such as calvarial fracture and acute bleeding in patients presenting with head trauma (1,2).

In cranial CT examinations, incidental lesions can be detected regardless of the trauma findings of the patients. Although these findings are independent of the present trauma, their detection and specifying them in radiology reports are important in terms of follow-up of the case. Technological developments and widespread use of CT scan increase the detection rate of incidental findings (IF) every day.

The aim of our study was to determine the prevalence of IF in healthy pediatric age group who were taken to CT for head trauma.

MATERIAL and METHODS

Between January and December 2016, cranial CT of 980 pediatric patients who presented to the ED of our hospital due to brain trauma were retrospectively reviewed. IF were evaluated simultaneously by a neuroradiologist and a neurosurgeon. The CT scans were performed on 16 slice multidetector CT (Toshiba Alexion, Otawara-shi, Tochigi, Japan). All brain CT scan films included 25-35sections (each slice3-5 mm in thickness) extending from the skull base through the vertex region. Our routine axial CT scans were performed with an angle parallel to the orbitomeatal line.

We enlisted all children who presented to the ED after head trauma within 24 hours of the traumatic event for whom a

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cranial CT scan was obtained, regardless of their Glasgow Coma Scale scores. Patients with neurologic disease, brain tumor, previous brain surgery or abormalities, ventricular shunt and coagulopathies were excluded.

Written informed consent was received from all patients, and the study protocol was approved by the hospital's local ethics committee (2019 /06) in accordance with the Helsinki Declaration and Good Clinical Practice Guidelines.

Data Collection

All cranial CT scans were interpreted by a faculty radiologists and a neurosurgeon retrospectively. All traumatic and non-traumatic CT findings were identified and entered into two seperate databases by faculty radiologist. Findings of acute sinusitis like sinus opacification and fluid level in sinuses were not agreed as an insidental finding because of its non-significant and common presentation.

Results

In our main study, we enrolled 980 head-injured children who received cranial CT scans in the ED. According to exclusion criteria, 146 of all were eliminated from the study. Of all remaining 834 patients, total of 86 patients (% 10.3) had IF on their CT scans. The 86 patients with IF had a median age of 6.8 years (1 week –17.4 years old) and 64 % were male. In our study; intracranial calcification was the most common incidental lesion in 14 patients (1.6%) while the least frequent one was the open lip schizencephaly in 2 patients (% 0.23) (Figure 1).

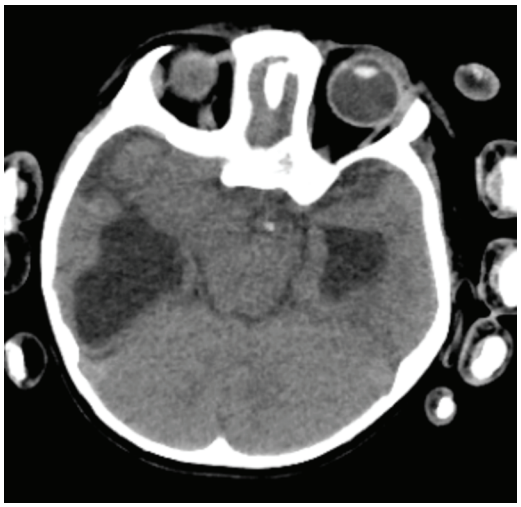

Figure 1. Unilateral Open Lip Schizencephaly: Axial cranial CT shows grey matter lined CSF cleft extending from the right lateral ventricle to the right frontotemporal cortex

The most of the detected lesions were benign asymptomatic lesions like arachnoid cyst (AC) (1.3%) (Figure 2), pineal gland cyst (1.07%) (Figure 3), Chiari 1 malformation (1.07%), cavum septum pellucidum (CSP) (0.95%) and so on. By the way as well as malignant lesions such as astrocytoma-diffuse glioma in 4 patients (0.47%) and potentially life-threating lesions like arterio-venous malformation (AVM) in 2 patients (0.23%) (Figure 4) were also detected. The IF of our study are detailed in Table 1.

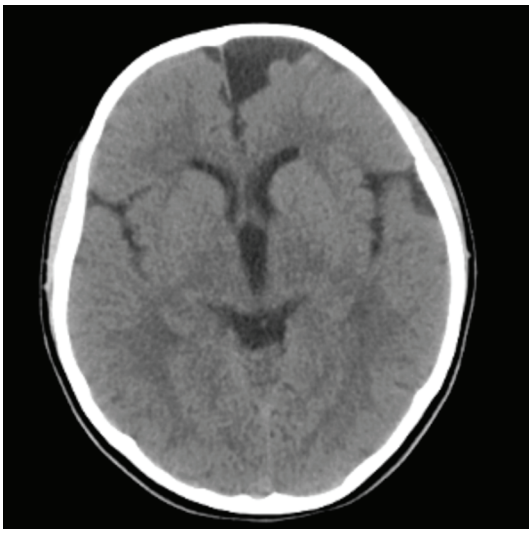

Figure 2. Arachnoid Cyst: Axial cranial CT: Small frontal arachnoid cyst anterior to the left frontal lobe

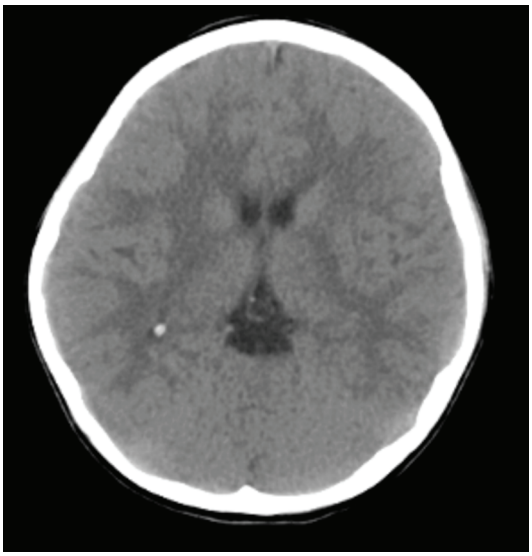

Figure 3. Pineal Cyst: Axial cranial CT image shows small (<1cm), round shape, isodense pineal gland cyst with milimetric cyst wall calcification

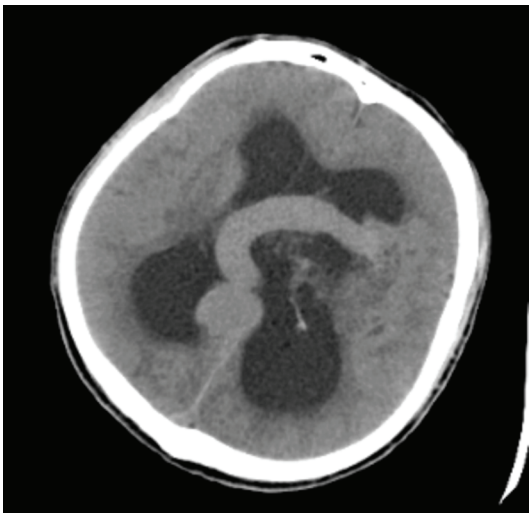

Figure 4. Cerebral arteriovenous malformation: Axial cranial CT image shows vein of Galen aneurysmal malformation with dilated lateral ventricules

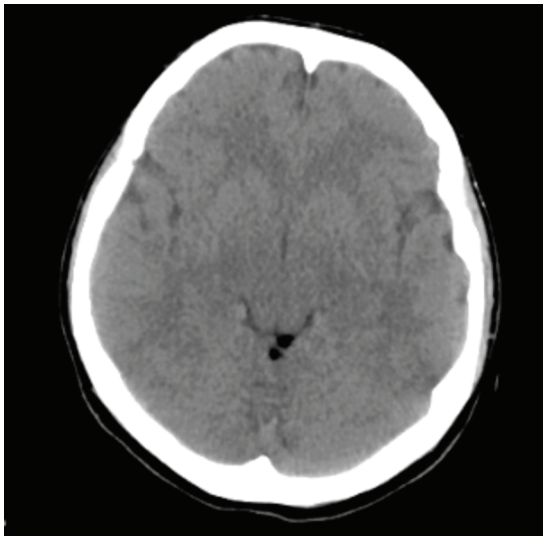

Figure 5. Intracranial lipomas: Axial cranial CT image shows low density quadrigeminal cistern lipoma

Table 1. Insidental Cranial CT Findings In Pediatric Patient With Head Trauma

Insidental findings	N (%)	Insidental findings	N (%)
Intracranial calcification	14 (% 1.6)	Tumor/mass (astrocytoma n.3 diffuse glioma n.1)	4(% 0.47)
Arachnoid cyst	11(% 1.3)	Open lip schizencephaly	2(% 0.23)
Pineal cyst	9(% 1.07)	Fibrous dysplasia	3(% 0.35)
Chiari malformation 1	9(% 1.07)	Arterio-venous malformation	2(% 0.23)
Cavum Septum Pellucidum	8(% 0.95)	Colloid cyst	3(% 0.35)
Cavum Septum Pellucidum et Vergae	5(% 0.59)	Dilated Virchow-Robin space	4(% 0.47)
Hydrocephalus	6(% 0.71)	Intracranial lipoma	6(% 0.71)

One hundered three of the 980 patients who presented to the ED due to head trauma and who had CT were thought to be severe head trauma. These patients were hospitalized, seven of the cases that were seen in the emergency room were operated. The others were followed. One hundered two cases were discharged in a healthy manner and 1 case was ex. The total length of hospital stay was between 1 to 23 days (mean 2.5 ± 2.2 days) and the duration of intensive care unit stay was between 1 to 14 days. There was no ex related with insidental findings during in-patient follow-up. Seven of the cases that were seen in the emergency room were operated.

DISCUSSION

In pediatric age group head trauma is one of the most common reason for ED appeal. Nowadays, with technologic achievements and easy access, advanced imaging studies -especially non-contrast cranial CT- are frequently used in head trauma (3). IF at imaging are defined as previously undetected abnormalities that are unexpectedly discovered and are unrelated to the purpose of the examination.

IF are the lesions that do not cause symptoms and usually do not require treatment. Therefore, it is difficult to assess the incidence in healthy population, especially in healthy children. In our study, we examined CT of pediatric age group whom they did not have history of prior chronic disease or malignancy. In this manner, we evaluated medically healthy pediatric population in our study. Our aim was to investigate prevelance of IF independent of trauma in healthy pediatric age group who applied to the ED for head trauma.

In the literature, most of the studies related with IF on cranial CT focus on the adult population, especially on pituitary tumor (4). Albeit, pediatric studies concerning IF are more commonly focused on findings identified with brain MRI (5-7). For this reason, our study is one of the few studies related with IF on cranial CT scans in healthy pediatric population.

The prevalence of IF on cranial CT in healthy children with head trauma was % 10.3 in our study. Previous studies associated with the prevalence of IF on cranial CT scans have shown wide variation ranging from 1% to 26 (8). This may be related with the lack of standardized definition of what represents incidental findings. Also parameters of CT scan, especially smaller slice thickness may lead to increased detection rate of IF by providing much more detailed images.

Intracranial calcification located in the habenular region (1.6 %) was the most common incidental findingin our study. Although physiological calcifications are common in CT and are very well known by radiologists, studies on their prevalence are limited. Physiological calcifications are important because they can be misinterpretted as hemorrhage at CT examinations of head trauma patients. Therefore, the differential diagnosis should be evaluated by experienced radiologists (9).

In our study, AC was detected in 11 (%1.3) cases. They are the most common intracranial cysts 0.3-1.4%. In CT , they are typically isodense with cerebrospinal fluid. AC are bening lesions and rarely seen in large size, soneurological deficit or clinical complaint related with AC is uncommon (10). In accordance with the literature, none of the patients with AC had epilepsy, neurological deficits or findings, in our study. Post-traumatic intrahemorrahagic AC are rarely seen in the cranium. The current situation was not observed in our cases. (11).

In our study, PC were seen in 9 (1.07%) cases, which were smaller than 1 cm in length and symptom free. Cystic changes in the pineal gland is an incidental finding with a prevalence of up to 10% (12). Larger cysts can compress the tectal plate and superior colliculus that leads Parinaud syndrome. Also they may compress cerebral aqueduct and lead to obstructive hydrocephalus, causing headache (13). In the case of heterogenous cystsor solid components, contrast-enhanced magnetic resonance imaging and follow-up with short intervals are recommended (14).

Chiari 1 malformation is the most common form of

congenital Chiari malformations. It is characterized by inferior position of cerebellar tonsils proportionate to the foramen magnum and usually asymptomatic. Although Chiari 1 malformations are frequently isolated entities, some associated findings such as hydrocephalus, platybasia, basillary invagination may be seen. In our study, 9 patients (1.07%) with Chiari 1 malformation was detected. There were no related clinical symptoms or associated abnormalities. This symptom free situation may be due to the low mean age of our study population. Although these cases are asymptomatic, evaluation of spinal cord with MRI is needed for high incidence of syringomyelia assosiations.

CSP is a relatively common neuroanatomical variant of the septum pellucidum between the right and left lateral ventricles in the medial frontal lobe of the brain. In some cases, the gap does not closed or partially closed and the CSP or CSP et vergae occurs (15). In our study, CSP and Cavum Septum Pellucidum Vergae was detected in 8(%0.95),5(%0.59) casesrespectively. None of the patients had epilepsy, neurological deficits or findings, in accordance with the literature.

Intracranial lipomas are approximately 0.1% of all intracranial tumors, largely in the midline. More than 50% have been reported to be associated with congenital brain malformations (16). In our study, intracranial lipoma was determined as 6 (0.71%) (Figure 5). There were no associated cranial malformations, neurological deficits or complaints related with intracranial lipoma. By the way, intracranial lipoma should be evaluated by experienced radiologists because it may be confused with air density in CT because of lipomas low density CT pattern. The intracranial free air (Pneumocephalia) is an important clue for traumatic brain injury, especially for cranial bone fracture in severe head traumas.

The term "cerebral arteriovenous malformation" (cAVM), denotes abnormally organised connection between the veins and arterial feeding of the brain, its prevalence is less than %1(17). AVM is an important etiologic factor for pediatric and adulthood intracerebral hemorrhages. (18). our study cAVM was detected in 2(%0.23) cases. One as dystrophic subcortical vascular calcification on cranial CT imagingand the second one as Galen Vein aneurysm. None of the patients had epilepsy, neurological deficits or findings at the time of presentation. Although they were clinically asymptomatic incidental findings, these cases require further investigation because of the potential for bleeding and associated syndromic diseases.

Schizencephaly is a rare congenital malformation and almost always sporadic. It is a type of cortical malformation reveals as a cleft extending from ventricular ependymal surface to the pia mater. It is divided into two morphological types as open-lip and closed-lip schizencephaly (19). In our study we detected open-lip schizencephaly in 2(%0.23) cases. Although seizure is the most common clinical presentation, none of our patients had epilepsy, neurological deficits or findings. This may be because the cases are in the neonatal period or may be due to unawereness of families.

Limitations of our study: It is a single-centered, retrospective study, sonumber of the cases included in the study is low. Also because of the retrospective pattern of the study, we are limited to evaluate long term clinical outcomes or radiological follow-up of the incidental findings.

With the frequent use of advanced diagnostic imaging techniques, physicians more often encountered with unexpected or unsought usually benign incidental findings.Although they are usually asymptomatic, some findings, such as hydrocephalus, tumor or mass, may lead to unexpected clinical changes and require immediate management. So patients with potentially life-threatening findings, early diagnosis may be of significant benefit.

From a medicolegal perspective revelation of all findings to families regardless to its clinical significance may be the safest way. On the other hand, this attempt increase risks of additional unnecessary diagnostic evaluation and health expenditure, also anxiety of patients and families. Knowledge of prevalence, clinical significance and outcomeof these findings may help physicians when informing patients and their relatives. In this respect, our study reveals an important evidence about prevalence and categorization of IF in healthy pediatric population.

CONCLUSION

The IF usually benign lesions with a good prognosis. In a few cases malignancy or potentially life-threatening clinical outcomes can be seen.In pediatric age group who have long life expectancy, it is important to determine IF and specify them at radiological reports. Besides, it is necessary to disclose the IF to the patients and families in an appropriate manner in order to decrease anxiety. From the medicolegal and ethical view follow up of these lesions with an appropriate protocol is neededin the ongoing process.

Competing interests: The authors declare that they have no competing interest.
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Ethical approval: Written informed consent was received from all patients, and the study protocol was approved by the hospital's local ethics committee (2019 /06) in accordance with the Helsinki Declaration and Good Clinical Practice Guidelines

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