NEW ONSET SEIZURES IN CHILDREN LESS THAN 2 YEARS: IS EMERGENT CT IMAGING NECESSARY?

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ABSTRACT

Background: Seizures being a common problem in paediatrics population especially in children less than 2 years old. Although Computed Tomography (CT) is invaluable in providing quick information for prompt clinical management, it has potential hazardous effects of an associated ionizing radiation which are concerning for frequent use. We are examining the yield of CT Brain findings in children less than 2 years old who presented with first episode of seizures without documented prior trauma.

Materials and Methods: A cross sectional descriptive study based on retrospective data of children less than 2 years old who had undergone CT Brain examination in Hospital Serdang during first presentation of seizures from January 2012 till June 2015. The images were reviewed by 2 radiologists with special interest in Paediatric Radiology and any discrepancy was resolved by consensus. Comparative study between afebrile and febrile groups was made.

Result: There were 377 CT Brain examinations performed in children less than 2 years old from January 2012 till June 2015, with 88 cases due to first episode of seizures without documented prior trauma. The age ranged between 1 to 23 months (mean 6.84 months, SD 5.223). A large proportion was represented by Malays (N=78; 88.6%) followed by foreigners/migrants (N=5; 5.7%), Chinese (N=3; 3.4%) and Indian (N=2; 2.3%). Male preponderance was noted with 61 cases (69.3%). 57 of cases had febrile seizures, while 31 of cases had afebrile seizures. Using a chi-square test, afebrile seizures were found to have significant association with abnormal CT Brain findings (N=25, 80.6%; p=0.005), intracranial bleed (N=16, 48%; p=0.001) and suspected non-accidental injuries (N=11, 35.5%; p=0.001).

Conclusion: Afebrile seizures in children less than 2 years old without documented trauma signify ominous risk of having abnormal CT Brain findings, intracranial bleed and suspected non-accidental injuries thus necessitate emergent imaging at presentation.

Keywords: seizures in children, CT scan.
1.0 Introduction

Seizures are a common problem in paediatrics population with a large proportion occurring in children less than 2 years old (Dayan et al, 2011). Computed Tomography (CT) is invaluable in providing quick information for prompt clinical management. However, potential hazardous effects of an associated ionizing radiation are concerning for frequent use. Therefore, the importance of emergent imaging including CT during the first presentation of seizures has been discussed at length with multiple guidelines produced, outlining the best standard of procedures involved (Hirtz et al, 2000; Gaillard et al, 2009; Dory et al, 2018; Hirtz et al, 2003).

Febrile seizures being the most common childhood seizures are described as brief seizures occurring within the first 24 hours onset of high fever without intracranial infection, metabolic disorders or prior afebrile seizures, which affect 2-5% of children between the ages of 6 to 60 months (Steering Committee on Quality Improvement and Management, Subcommittee on Febrile, 2008). Although there is concern for potential long-term sequelae, such as increased risk of epilepsy and recurrent febrile seizures, neuroimaging for simple febrile seizures is not recommended (Dory et al, 2018). However, neuroimaging may be indicated in complex febrile seizures, thus, a clinical distinction and recognition between complex and simple seizures is paramount.

The Quality Standards Subcommittee of the American Academy of Neurology (Hirtz et al, 2000) concluded that there was insufficient evidence to recommend the use of routine neuroimaging in the first unprovoked seizures. However, they recommended emergent neuroimaging in children with delayed resolution of post-ictal focal deficit. Furthermore, afebrile seizures in neurologically intact children below 2 years of age without prior medical illness or documented trauma should be considered for emergent CT evaluation, as it may be a presentation for non-accidental injury (Dory et al, 2018).

Therefore, we would like to retrospectively observe the practice and yield of CT Brain examinations of children below 2 years old who presented with the first episode of seizures in our local setting, comparing between the febrile and afebrile groups.

2.0 Materials and Methods

Retrospective review of CT Brain done on Hospital Picture Archiving and Communication System (PACS), of patients less than 2 years old in Hospital Serdang, a secondary referral centre, from January 2012 till June 2015 was performed following approval from Medical Research and Ethical Committee (MREC) of Malaysian Medical Council (NMRR-15-502-25467). All CT Brain examinations indicated for the first presentation of seizures in this age group without documented prior trauma were included in the study. CT Brain examinations for other indications, seizures with prior history of trauma or without clear clinical indications, were excluded from the study. The CT images were then reviewed by two radiologists with special interest in Paediatrics imaging and findings were noted by
consensus. The CT Brain findings detected including intracranial haemorrhages, cerebral oedema, cerebral atrophy, intracranial calcifications, collections and space occupying lesions were documented. These cases were further divided into febrile and afebrile seizures for comparative study. The chi-square test was used to look at the association of the CT Brain findings.

3.0 Result

3.1 Study demography

There were 377 CT Brain examinations performed for children less than 2 years of age for various medical indications from January 2012 to June 2015. Out of these 377 cases, 88 cases were indicated for the first presentation of seizures. The age ranges from 1 to 23 months of age with mean age of 6.84 months. A large proportion was represented by Malays (N=78; 88.6%) followed by foreigners/migrants (N=5; 5.7%), Chinese (N=3; 3.4%) and Indian (N=2; 2.3%). Whereas, gender distribution showed 61 male patients against 27 female patients. There were 57 cases of febrile seizures and 31 cases of afebrile seizures.

3.2 CT Brain findings

Abnormal CT Brain findings were demonstrated in the majority (25 cases) of afebrile cases, whereas equal distribution of normal and abnormal CT findings was seen in the febrile cases. A significant association between afebrile fits with presence of intracranial bleed and suspected non-accidental injury was further demonstrated.

The study demographic distribution and CT Brain findings are represented by Table 1 with comparison between febrile and afebrile cases.

Table 1: Study demography with summary of the CT Brain findings

<table>
<thead>
<tr>
<th></th>
<th>AFEBRILE</th>
<th>FEBRILE</th>
<th>χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENDER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MALE</td>
<td>20 (64.5%)</td>
<td>41 (71.9%)</td>
<td></td>
</tr>
<tr>
<td>FEMALE</td>
<td>11 (35.5%)</td>
<td>16 (28.1%)</td>
<td></td>
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<tr>
<td>CT FINDINGS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NORMAL</td>
<td>6 (19.4%)</td>
<td>28 (49.1%)</td>
<td>0.005</td>
</tr>
<tr>
<td>ABNORMAL</td>
<td>25 (80.6%)</td>
<td>29 (50.9%)</td>
<td></td>
</tr>
<tr>
<td>CEREBRAL OEDEMA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>12 (38.7%)</td>
<td>33 (57.9%)</td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>19 (61.3%)</td>
<td>24 (42.1%)</td>
<td></td>
</tr>
<tr>
<td>ICB (Intracranial bleed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>16 (52%)</td>
<td>48 (84.2%)</td>
<td>0.001</td>
</tr>
<tr>
<td>YES</td>
<td>15 (48%)</td>
<td>9 (13.8%)</td>
<td></td>
</tr>
<tr>
<td>Collection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>31 (100%)</td>
<td>51 (89.5%)</td>
<td></td>
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<tr>
<td>YES</td>
<td>0</td>
<td>6 (10.5%)</td>
<td></td>
</tr>
<tr>
<td>SOL (Space occupying lesion)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>29 (93.5%)</td>
<td>55 (96.5%)</td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>2 (6.5%)</td>
<td>2 (3.5%)</td>
<td></td>
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<tr>
<td>CALCIFICATION</td>
<td></td>
<td></td>
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<tr>
<td>NO</td>
<td>26 (83.9%)</td>
<td>57 (100%)</td>
<td>0.004</td>
</tr>
<tr>
<td>YES</td>
<td>5 (16.1%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>C_ATROPHY (Cerebral Atrophy)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>27 (87.1%)</td>
<td>55 (96.5%)</td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>4 (12.9%)</td>
<td>2 (3.5%)</td>
<td></td>
</tr>
</tbody>
</table>
4.0 Discussion

The mean age at presentation in our study was 6.78 months concurs with a prior study by Pallin et al (2008) which showed children one-year-old and below, being the most common age group to present to an Emergency Department with seizures compared with other age groups. Their study also showed higher representation by male gender compared with female gender, which agrees with our study population of male preponderance. Male gender predominance was also shown in a study by Hsieh et al (2010) with male gender represented 52% of the study population.

Abnormal CT Brain findings were seen in larger proportion of patients presented with afebrile seizures which accounted for 81% as opposed to 51% in the febrile group. Our study showed a much higher prevalence of abnormal CT Brain findings compared with prior studies in both febrile and afebrile groups. Abnormal CT Brain findings in afebrile seizures were documented only between 7-24% on the special report on guidelines for imaging infants and children with recent onset epilepsy by Gaillard et al (2009). Slightly higher abnormal CT representation of almost a third of the cases, was shown by a study by Hsieh et al (2010) where their study population was between 1 to 24 months of age. However, only a minor proportion of these cases requiring acute medical treatment.

Our study further demonstrated a significant association between afebrile seizures with presence of intracranial haemorrhages (48%) and suspected non-accidental injuries (35%) which required emergent intervention either surgically or medically. These findings concur with the recommendation by the American College of Radiology Appropriateness Criteria to consider CT examination in this age group, for possible presentation of non-accidental trauma (Dory et al, 2018). However, the significantly higher prevalence of the abnormal CT Brain findings in our study may be due to other significant clinical findings which were not assessed in this current study, as we were only concentrating on the imaging findings. Therefore, subsequent study which includes other clinical findings should be done for more comprehensive results.

Although CT can be considered in patients with complex febrile seizures, a study by Teng et al (2006) on 71 patients, showed none of these patients had intracranial pathology that required emergency intervention. Furthermore, another study by Kimia et al (2012) on 526 patients with complex febrile seizures, from which 268 patients had imaging, only 1.5% of patients had clinically significant imaging findings. These studies are contrary to our findings in which almost equal number of patients with first febrile seizures had abnormal CT findings with cerebral oedema being the most common findings. Cerebral oedema on CT examination is non-specific, which could be related to the causative factors or as sequelae of complex seizures. It was speculated that these cases were only considered for CT examination with the intention of performing cerebrospinal fluid examination in suspected meningitis, hence, more
abnormal findings were detected. Therefore, more comprehensive study is needed in the future to include those patients who were managed without neuroimaging to get more informative and conclusive results.

Our study showed a small percentage of cases with space occupying lesions, with 0.06% in afebrile group and 0.035% in febrile group. This result concurs with the annual incidence rate in the United State of 35 cases per million, based on Surveillance, Epidemiology and End Results (SEER) data from 1986 to 2006 (Bishop et al, 2012).

Our study was done in a single centre, with limited number of cases, may invite bias. Furthermore, being a non-paediatric referral centre, most of our cases which required further intervention were transferred out to another centre, thus the information on subsequent management was lost. However, our study managed to highlight the importance of emergent CT Brain examination for afebrile fits in this age group.

5.0 Conclusion and recommendation

First afebrile seizures in children less than 2 years old although common, is concerning for associated intracranial haemorrhages and suspected non-accidental injury. Therefore, emergent CT Brain imaging is to be considered for such cases for prompt surgical or medical intervention.

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Declaration

Author(s) declare that there was no conflict of interest among authors.

Authors contribution

Author 1: Hasyma Abu Hassan (project leader, literature review, image interpretation, result analysis, write-up)

Author 2: Norafida Bahari (image interpretation, result analysis)
Author 3: Subapriya Suppiah (literature review, result analysis, write-up)

Author 4: Suraini Mohamed Saini (literature review, write-up)

Author 5: Iskasyamar Itam (literature review, result analysis)

References


