ELSEVIER

Brain & Development 36 (2014) 10–15

BRAIN & DEVELOPMENT
Official Journal of the Japanese Society of Child Neurology

www.elsevier.com/locate/braindev

Original article

Quantitative evaluation of ventricular dilatation using computed tomography in infants with congenital cytomegalovirus infection

Kiyomi Matsuo [a,1], Ichiro Morioka [a,*,1], Mai Oda [b], Yoko Kobayashi [d], Yuji Nakamachi [d], Seiji Kawano [d], Miwako Nagasaka [a], Tsubasa Koda [a], Tomoyuki Yokota [a], Satoru Morikawa [a], Akihiro Miwa [a], Akio Shibata [a], Toshio Minematsu [e], Naoki Inoue [f], Hideto Yamada [c], Kazumoto Iijima [a]

[a] *Department of Pediatrics, Kobe University Hospital, Kobe, Japan*
[b] *Department of Radiology, Kobe University Hospital, Kobe, Japan*
[c] *Department of Obstetrics and Gynecology, Kobe University Hospital, Kobe, Japan*
[d] *Department of Clinical Laboratory, Kobe University Hospital, Kobe, Japan*
[e] *Research Center for Disease Control, Aisenkai Nichinan Hospital, Nichinan, Japan*
[f] *Department of Virology I, National Institute of Infectious Disease, Tokyo, Japan*

Received 1 October 2012; received in revised form 19 December 2012; accepted 20 December 2012

Abstract

Background: Infants with congenital cytomegalovirus infection (CCMVI) may develop brain abnormalities such as ventricular dilatation, which may potentially associate with sensorineural hearing loss. There is currently no recognized method for quantitative evaluation of ventricle size in infants with CCMVI. Our objectives were to establish a method for quantitative evaluation of ventricle size using computed tomography (CT) in infants with CCMVI, and determine a cut-off value associated with abnormal auditory brainstem response (ABR) early in life.

Design/Subjects: This study enrolled 19 infants with CCMVI and 21 non-infected newborn infants as a control group. Infants with CCMVI were divided into two subgroups according to ABR at the time of initial examination: normal ABR (11 infants) or abnormal ABR (8 infants). Ventricle size was assessed by calculating Evans' index (EI) and lateral ventricle width/hemispheric width (LVW/HW) ratio on brain CT images, and was compared among groups. A cut-off ventricle size associated with abnormal ABR was determined.

Results: EI and LVW/HW ratio were significantly higher in the CCMVI with abnormal ABR group than the control and CCMVI with normal ABR groups. Cut-off values of 0.26 for EI and 0.28 for LVW/HW ratio had a sensitivity of 100% and 100%, respectively, and a specificity of 73% and 91%, respectively, for association with abnormal ABR.

Conclusions: We established a method for quantitative evaluation of ventricle size using EI and LVW/HW ratio on brain CT images in infants with CCMVI. LVW/HW ratio had a more association with abnormal ABR in the early postnatal period than EI.
© 2012 The Japanese Society of Child Neurology. Published by Elsevier B.V. All rights reserved.

Keywords: Auditory brainstem response; Cytomegalovirus infection; Evans' index; Lateral ventricle width/hemispheric width ratio; Ventricle

* Corresponding author. Address: Department of Pediatrics, Kobe University Hospital, 7-5-1 Kusunoki-cho, Chuo-ku, Kobe 650-0017, Japan. Tel.: +81 78 382 6090; fax: +81 78 382 6099.
E-mail address: ichim@med.kobe-u.ac.jp (I. Morioka).
[1] These authors contributed equally to this work.

1. Introduction

Cytomegalovirus (CMV) is the main pathogen causing congenital infection in developed countries [1] and

0387-7604/$ - see front matter © 2012 The Japanese Society of Child Neurology. Published by Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.braindev.2012.12.009

affects 0.31% of live newborn infants in Japan [2]. Approximately 10–15% of infants with congenital CMV infection (CCMVI) have clinical manifestations at birth such as jaundice, hepatosplenomegaly with or without liver dysfunction, thrombocytopenic purpura, chorioretinitis, and abnormalities of the central nervous system. Of such symptomatic infants, approximately 80–90% develop major neurological sequelae including sensorineural hearing loss (SNHL) and developmental disabilities [1].

Previous studies have shown that brain abnormalities, including intracranial calcification and ventricular dilatation (VD), are associated with the development of SNHL [3–5] and can be used to predict SNHL in infants with CCMVI [4,5]. Computed tomography (CT) images are still considered in infants with suspected CCMVI in the early postnatal period to rule out calcifications or VD of their brains, although magnetic resonance imaging (MRI) and ultrasound examinations have widely spread in Japan. VD has been generally assessed qualitatively (presence or absence of VD) or semi-quantitatively based on CT images (mild, moderate, or severe VD) [3–5]. However, because such assessment has yielded inconsistent results among pediatric radiologists [3], it is critical to establish a method for quantitative evaluation of ventricle size that can provide a more accurate marker of SNHL in infants with CCMVI.

Evans' index (EI), the ratio of the maximum width of the frontal horns of the lateral ventricles to the greatest internal diameter of the skull, is the most well-known index for quantitative evaluation of ventricle size on CT images [6]. International guidelines for the diagnosis of hydrocephalus define VD as EI > 0.3 [7,8]. The lateral ventricle width/hemispheric width (LVW/HW) ratio is the standard index used for evaluation of fetal VD on ultrasound examination [9–12]. No reported studies to date have used either EI or LVW/HW ratio to assess VD on CT images in infants with CCMVI.

The aims of this study were to establish a method for quantitative evaluation of ventricle size using CT images to obtain EI and LVW/HW ratio, and to determine cut-off values for EI and LVW/HW ratio associated with abnormal auditory brainstem response (ABR) in infants with CCMVI early in life.

2. Methods

2.1. Study design

This study was conducted from April 2009 to March 2012 at Kobe University Hospital. The collections and uses of human materials for this study were approved by the Ethical Committee of Kobe University Graduate School of Medicine. Written informed consent was obtained from the parents of the enrolled infants.

Infants of mothers who had confirmed or suspected primary CMV infection were enrolled in this study. All of them underwent blood testing, CMV-DNA analysis, brain CT, ABR evaluation, and ophthalmologic examination. CMV-DNA analysis was used to allocate infants to the CCMVI or control groups. The CCMVI group was divided into two subgroups according to ABR: CCMVI with normal ABR and CCMVI with abnormal ABR. The clinical background characteristics of all enrolled infants were recorded, including gestational age, birth weight, gender, initial physical examination findings, and postconceptional age at the time of brain CT and ABR evaluation. EI and LVW/HW ratio were obtained as shown in Fig. 1. Clinical background characteristics, EI, and LVW/HW ratio were compared among the groups (control, CCMVI, CCMVI with normal ABR, and CCMVI with abnormal ABR). Finally, cut-off values for EI and LVW/HW ratio associated with abnormal ABR were determined.

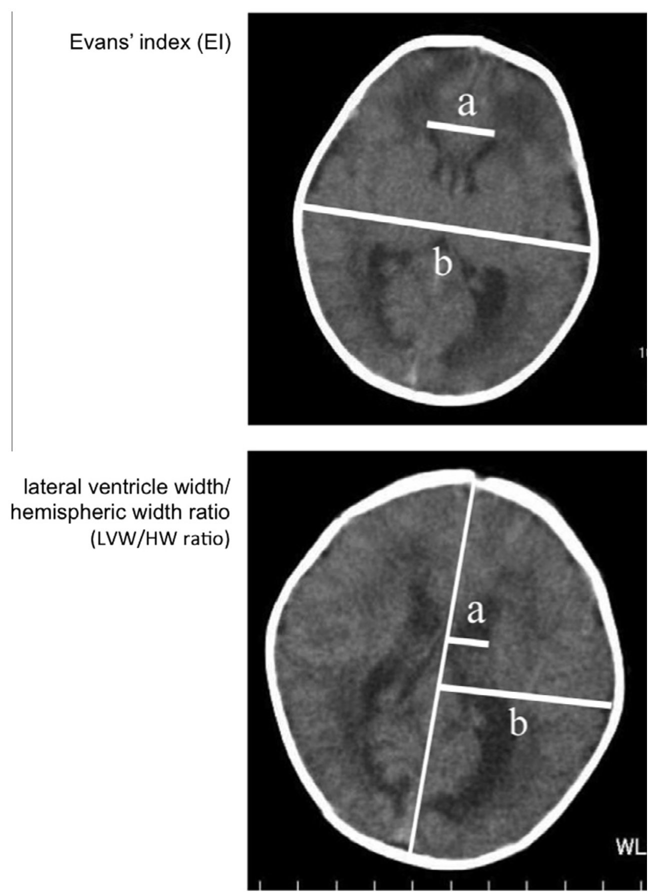

Fig. 1. Quantitative evaluations of ventricle size: Evans' index (EI) and lateral ventricle width/hemispheric width (LVW/HW) ratio. EI = maximum width of the frontal horns of the lateral ventricles (a)/internal diameter of the skull (b), LVW/HW ratio = maximum lateral ventricle width (a)/hemispheric width (b).

Download English Version:

https://daneshyari.com/en/article/3037101

Download Persian Version:

https://daneshyari.com/article/3037101

Daneshyari.com