



ORIGINAL ARTICLE

Non-accidental brain trauma in infants: diffusion imaging, contributions to understanding the injury process

Traumatismes non accidentels du nourrisson : imagerie de diffusion, contributions dans la compréhension des mécanismes

R.A. Zimmerman^{a,*}, L.T. Bilaniuk^a, L. Farina^b

^a Department of Radiology, Wood Room 2115, The Children's Hospital of Philadelphia, 34th Street and Civic Center boulevard, Philadelphia, PA 19104, USA

^b Istituto Nazionale Neurologico "Carlo Besta", Milano, Italy

KEYWORDS

Non-accidental trauma;
Imaging;
Child abuse;
MRI;
MRI diffusion imaging;
Traumatic

MOTS CLÉS

Traumatisme non
accidental ;
Imagerie ;
Séviçes ;
IRM ;
Imagerie de diffusion ;
Traumatisme

Abstract Analysis of MRI diffusion images from 33 infants suffering from non-accidental trauma reveals five patterns of injury. These are diffuse supratentorial hypoxic ischemic, watershed hypoxic ischemic, venous infarction, diffuse axonal injury and contusion.

© 2007 Elsevier Masson SAS. All rights reserved.

Résumé L'analyse de l'IRM de diffusion chez 33 enfants atteints de traumatisme non accidentel met en évidence cinq différents types d'atteinte cérébrale. Ils incluent des lésions hypoxo-ischémiques diffuses supratentorielles, des lésions hypoxo-ischémiques des territoires vasculaires jonctionnels, des infarctus veineux, des lésions axonales diffuses et des contusions.

© 2007 Elsevier Masson SAS. All rights reserved.

* Corresponding author.

E-mail address: zimmerman@email.chop.edu (R.A. Zimmerman).

Introduction

Since the introduction of diffusion-weighted imaging (DWI) in the mid-1990s as a tool in the identification of acute cytotoxic cell edema, the technique's major clinical application has been to evaluate adult stroke [9,10] and neonatal hypoxic ischemic brain injury [1,12]. To a lesser extent, DWI has made contributions in the characterization of central nervous system (CNS) metabolic disorders [8], certain pediatric brain tumors [4] and cerebral traumatic lesions [7].

This paper looks at the patterns of DWI abnormalities in non-accidental trauma (NAT) in infants and young children who have been the victims of abuse. This is a subject that has received relatively little attention in the literature [2, 11].

Materials and methods

Thirty-three infants and young children, 22 males and 11 females, ranging from 3 weeks to 4 years of age, were evaluated with MRI and DWI over a 4-year period of time. Twenty-five of 33 (76%) were 6 months or younger.

All of the patients selected for this study had an acute brain injury with a positive DWI (restricted motion of water). The 33 patients had a total of 57 CT and 40 MRI examinations during the acute phase of hospitalization following trauma. In all cases a CT preceded the MRI evaluation.

CT examinations utilized a single slice Siemens Somatom CT scanner with a slice thickness of 5 mm, 120 kV and a 1-s scan time with images displayed in brain, subdural and bone windows. MRI scans were performed on one of three Siemens 1.5 Tesla MRI units, sagittal and axial 5 mm spin

echo T1WI images were performed with TR = 1000 ms, TE = 11 ms; axial and coronal T2WI 5 mm T2WI with TR = 6000, TE = 99 ms, an axial 5 mm T2 gradient echo susceptibility scan with a TR = 636 ms, TE = 12 ms and an axial single shot DWI with a TR = 4300 ms and a TE = 85 ms. The DWI is performed with B0, B500 and B1000 set of images, from which an apparent diffusion coefficient (ADC) is calculated.

Results

Five imaging patterns were found with DWI in the 33 patients with NAT. One type consisted of diffuse supratentorial brain swelling (infarction) involving the cortex and white matter of all cerebral lobes bilaterally. This was present in 13/33 (39%) (Fig. 1). The second pattern showed watershed infarction involving the parasagittal region between the anterior and middle cerebral arteries anteriorly and the posterior middle cerebral arteries posteriorly. In some cases there was also involvement of the inferior temporal lobes between middle and posterior cerebral arteries and the cerebellar hemispheres between the three vascular territories supplying the cerebellum (Figs. 2 and 3). Supratentorial watershed infarctions were found in 12/33 (36%), while two of these 12 also had cerebellar watershed infarctions 2/33 (6%). The third pattern of DWI consisted of venous infarction occurring in the parieto-occipital region unilaterally at the site of venous disruption of bridging veins, 4/33 (12%) (Fig. 4). The fourth pattern was that of diffuse axonal injury (DAI), found in only 2/33 (6%) (Fig. 5). The fifth pattern of injury was that of the contusion, a focal superficial injury at the point of the brain impact on adjacent bony surface of the skull, 2/33 (6%) (Fig. 6).

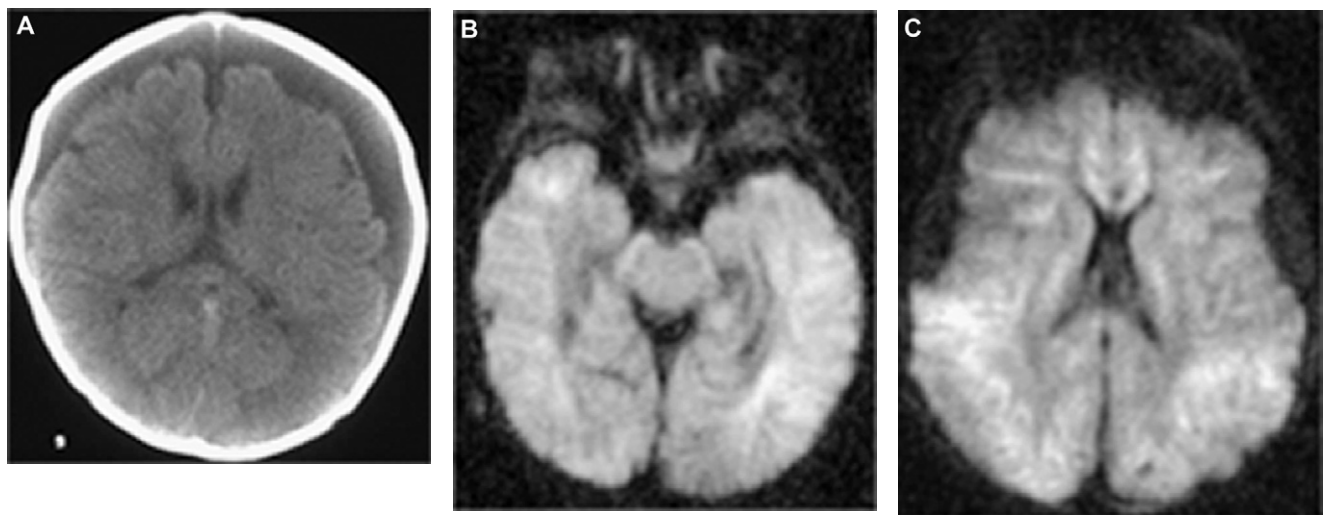


Figure 1 Diffuse supratentorial hypoxic ischemic injury. Eight-week-old male with new onset of seizures, blown left pupil and bulging anterior fontanelle. A: CT on admission to ER, shows bilateral chronic subdural collection; B and C: MRI axial diffusion study, B1000 image, performed 16 hours after CT, shows diffusely restricted motion of water in the supratentorial brain.

Figure 1 Lésions hypoxo-ischémiques diffuses supratentorielles. Nourrisson de huit semaines avec convulsions, mydriase gauche, et bombement de la fontanelle antérieure. A : TDM à l'admission aux urgences : collection sousdurale chronique bilatérale ; B, C : Images axiales en pondération de diffusion (B 1000), réalisées 16 heures après le scanner : restriction de la diffusion au niveau supratentoriel.

Download English Version:

<https://daneshyari.com/en/article/4234590>

Download Persian Version:

<https://daneshyari.com/article/4234590>

[Daneshyari.com](https://daneshyari.com)