

# Convulsions and retinal haemorrhage: should we look further?

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**Background and Aims:** The prevalence of retinal haemorrhages after convulsions is not well established. As these haemorrhages are considered characteristic of child abuse, we investigated their occurrence after convulsive episodes to see whether the finding of haemorrhage should prompt further investigation.

**Methods:** Prospective study of 153 children (aged 2 months to 2 years), seen in the emergency department after a convulsive episode. After a thorough history and physical examination, a retinal examination was performed by an ophthalmologist. If findings were positive, further investigation was undertaken to rule out systemic disorder or child abuse.

**Results:** One child was found with unilateral retinal haemorrhages following an episode of a simple febrile convulsion. A thorough investigation uncovered no other reason for this finding.

**Conclusion:** Retinal haemorrhages following a convulsive episode are rare. Such a finding should trigger an extensive search for other reasons, including child abuse.

Retinal haemorrhages in infancy and childhood are important clinical findings. They may result from a variety of systemic diseases as well as accidental and non-accidental injuries. In the absence of the former, the clinical sign of retinal haemorrhages is suspicious of physical child abuse.<sup>1,2</sup> It has been suggested that retinal haemorrhages with no sign of disease are sufficient to diagnose child abuse.<sup>1</sup>

The prevalence of retinal haemorrhage after convulsions remains unclear. Studies have concluded that the chances of developing haemorrhage after convulsions are low,<sup>3,4</sup> but these studies were too small to rule it out. We therefore conducted a large prospective study to estimate better the prevalence of this sign in children with convulsions. Our purpose was to help clinicians deal with a child presenting with retinal haemorrhages after a convulsion: must child abuse be ruled out or is the diagnosis of post-convulsion retinal haemorrhage firm enough to explain the findings?

## PATIENTS AND METHODS

### Patients

Children aged 2–24 months presenting to our paediatric emergency medicine department with a diagnosis of convulsions between November 1998 and June 2000 were included in the study. Children with a history of trauma, suspected child abuse, or cardiopulmonary resuscitation were excluded. All study subjects were full term, previously healthy infants.

### Methods

A detailed history was taken to categorise the nature of the disorder, the duration and clinical expression of the seizure, and any associated resuscitation or injury. A seizure was classified as febrile if it was accompanied by fever without evidence of bacterial intracranial infection or a history of non-febrile seizures. Febrile seizures were divided into simple and complex: they were considered simple if they lasted less than 15 minutes, were generalised, and did not recur within 24 hours.

Complete physical and neurological examinations were performed on all children. The policy at our institute was to perform fundi examination on all seizing children as part of the physical examination. Fundi were examined by a trainee

or an expert ophthalmologist using indirect ophthalmoscopy, in the majority of cases without indentation, within 24 hours of the convulsive episode. The pupils were dilated with tropicamide 0.5% eye drops before examination. For children with positive findings, extensive social inquiry in the hospital and community was undertaken, along with coagulation studies.

As we presumed that post-convulsion retinal haemorrhage is rare, we used the binomial test to estimate the statistical probability of such an event.

## RESULTS

A total of 153 children (mean age (SD), 14.3 (5.4) months) with convulsions were examined. There were 77 boys (50.3%) and 76 girls (49.7%); 92 were Jews and 61 Arabs. Of the total, 135 (88.2%) children had febrile seizures, including two with aseptic meningitis; 97 (63.4%) of them had simple seizures and 38 (24.8%) complex seizures. Eighteen (11.8%) children had non-febrile seizures, of which three cases followed a diphtheria–tetanus–pertussis immunisation. Mean (SD) duration of the seizures was 6.7 (10.5) minutes; 14 episodes were prolonged, lasting 15 minutes or more.

Funduscopy examination showed unilateral retinal haemorrhages in one 8 month old girl. Flame shaped haemorrhages were noted around the left disc, which had normal margins with no signs of swelling. The retina on the right eye was normal. Her seizures were simple tonic–clonic febrile seizures that lasted five minutes and were not accompanied by bouts of vomiting or resuscitation procedures. A detailed history and social inquiry raised no suspicion of child abuse. A skeletal survey and computed tomographic scan of the head were normal. No coagulopathy was found. The retinal findings were confirmed on a second funduscopy examination 24 hours after admission. After six months follow up, no evidence of abuse was found, the retinal haemorrhages resolved, and the child appeared normal and healthy.

According to our study, the prevalence of retinal haemorrhage secondary to convulsions was 0.0065. Application of the binomial test indicated that the probability of this event was rare and that its prevalence in our study was the same as that found in one case of retinal bleeding out of 1000 children with convulsions (95% confidence interval 0.00016 to 0.03588,  $p > 0.1$ ).

## DISCUSSION

Retinal haemorrhages occur when blood extravasates from blood vessels, usually capillaries and post-capillary venules. Their pattern and severity vary and can involve all the retinal layers or be confined to part of them. They can be unilateral or bilateral, localised or generalised.

Such haemorrhages are common in the neonatal period. Their incidence, cause, and significance in newborns have been widely studied.<sup>5-8</sup> Because of the high incidence of retinal haemorrhage in this group, we chose a minimum age of 2 months for our study.

The causes of retinal haemorrhage range from benign to life threatening conditions. It may be present in subarachnoid haemorrhage in about 20%,<sup>9</sup> or follow subdural haemorrhage.<sup>10</sup> It is often seen in infants and children with injuries (including child abuse), trauma,<sup>11-14</sup> vomiting or bouts of coughing,<sup>15</sup> and resuscitation.<sup>12-19</sup> Other causes are retinal diseases such as retinopathy of prematurity and Coats' disease; systemic diseases such as blood dyscrasias, hyperviscosity states, hypertension, and anoxia; and infections such as cytomegalovirus, herpes simplex, rickettsial infections, toxoplasmosis, and endocarditis.<sup>20</sup>

The prevalence of retinal haemorrhage after convulsions has not been established. Although the sagittal venous pressure measured during tonic seizures in status epilepticus has been known to be three to four times higher than normal,<sup>21</sup> Sandramouli *et al*, in a study of 32 children (aged 4 months to 14 years) with convulsive episodes, found that none developed retinal haemorrhage.<sup>3</sup> Tyagi *et al* found no cases of retinal haemorrhage in 32 infants less than 2 years old who had suffered convulsions, concluding that although the vasculature of infants is more vulnerable, their chances of developing haemorrhage after convulsions are low.<sup>4</sup> These studies were too small to rule out haemorrhage after convulsions. According to Tyagi *et al*, the probability of post-convulsion haemorrhage in children younger than 2 years is at most 10%, and when both studies are combined, the probability of haemorrhage in children younger than 14 years is less than 5%. Statistically it has been shown that proving prevalence less than 1% requires examining 300 children and finding normal fundi in all of them.<sup>22</sup>

Although our study group was much larger than those in earlier studies, as we did not examine all the patients by indentation we cannot exclude peripheral retinal hemorrhage. The finding of one child with retinal haemorrhage necessitates a larger group, which will include indentation to obtain a better statistical estimate of its prevalence following convulsions. Another limitation is that although the haemorrhage appeared to be of new onset, we could not prove a direct connection between the convulsive episode and the haemorrhage.

Our study found that the likelihood of developing retinal haemorrhage after convulsions was less than 1%. We conclude that although theoretically convulsions can cause retinal haemorrhage in children, the prevalence is extremely low. The

finding of retinal haemorrhage in a child after a convulsive episode should therefore trigger an extensive search for other causes, including child abuse.

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