

## Ischaemic stroke following minor head trauma: a case report and review of the literature

### 外傷後缺血性中風：病例報告和文獻回顧

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Head trauma is one of the leading causes of emergency department (ED) presentations. However, ischaemic stroke due to the minor head trauma is an unusual and unexpected condition for ED physicians. We report a ten-month-old boy was presented to the ED with disability in the left leg and arm. The child fell off the bed to the floor from a height of approximately 0.5 meter while sleeping. The cranial computed tomogram scan revealed a hypodense lesion in the posterior limb of right internal capsule that was consistent with brain infarct. ED physicians may consider a possible ischaemic stroke in children presented with minor head trauma without any pathological finding on the physical examination. (Hong Kong j.emerg.med. 2013;20: 392-395)

頭部外傷是到診急診科 (ED) 的主要原因之一。然而，輕微的頭部外傷引發缺血性中風，是一個不尋常和ED醫師意想不到的狀況。我們報告一例10個月大到診急診科左腿和手臂偏癱的男孩。孩子睡覺時從約0.5米高的床上摔下地板來。顱電腦斷層掃描顯示符合腦右側內囊後肢梗塞的低密度病灶。兒童輕微的頭部外傷而沒有任何病理體檢發現，ED醫師可考慮是否有可能缺血性中風。

**Keywords:** Brain injury, child, cerebrovascular accident, injuries and wounds

**關鍵詞：**腦損傷、兒童、腦血管意外、受傷和傷口

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## Introduction

Head trauma is one of the leading causes of emergency department (ED) presentations. Neurological disabilities due to the injuries following head trauma such as cerebral contusion, diffuse axonal injury, parenchymal haemorrhage and subarachnoid haemorrhage are not uncommon.<sup>1</sup> However, ischaemic stroke due to the minor head trauma is an unusual and unexpected condition for ED physicians. In the present case report, we report an unusual cause of ischaemic stroke following minor head trauma.

## Case report

A ten-month-old boy was presented to the ED with disability in the left leg and arm. The child fell off the

bed to the floor from a height of approximately 0.5 meter, while he was sleeping with his family. Although his family did not witness his fall injury, they woke up by his cry and found him lying on the floor. During the following two days, they noticed that their child had used his left arm and left leg less than the opposite side. The patient was alert and his vital signs were stable during the initial ED presentation. On the physical examination, he had muscle weakness with power of 2/5 in the left arm and 4/5 in the left leg. He had also babinski's sign on the left. There was no pathological sign indicating head trauma and the remaining physical examination was normal. In the past medical history, the child was born with cesarean section without any complication. His psychomotor development was normal so far.

The coagulation profile, complete blood count and biochemical analysis were within normal limits. The cranial computed tomogram (CT) scan obtained in ED revealed a hypodense lesion in the posterior limb of right internal capsule that was consistent with brain infarct (Figure). He was admitted to the paediatric neurology ward. The magnetic resonance imaging (MRI) obtained two days later revealed a 1.5 cm of an area with restricted diffusion in the right globus pallidus, putamen and in the posterior limb of the internal capsule which was also consistent with cerebral infarct. This infarct area was related to the trace of the lenticulostriate artery, a branch of middle cerebral artery. Lumbar puncture with a normal brain spinal fluid analysis excluded meningitis. Both MRI angiography and cerebral angiography performed via femoral artery cannulation excluded a thrombus and vasculitis in cerebral arteries. The blood analysis to detect antithrombin III, anti-kardiolipin antibodies, anti-mitochondrial antibodies and lupus anticoagulant 1 in order to reveal a condition predisposing to thromboembolism was all negative. Echocardiography also excluded the existence of a thrombus. Ultimately, the patient had been diagnosed as having an ischaemic stroke due to the head trauma and heparin was administered as the initial therapy.

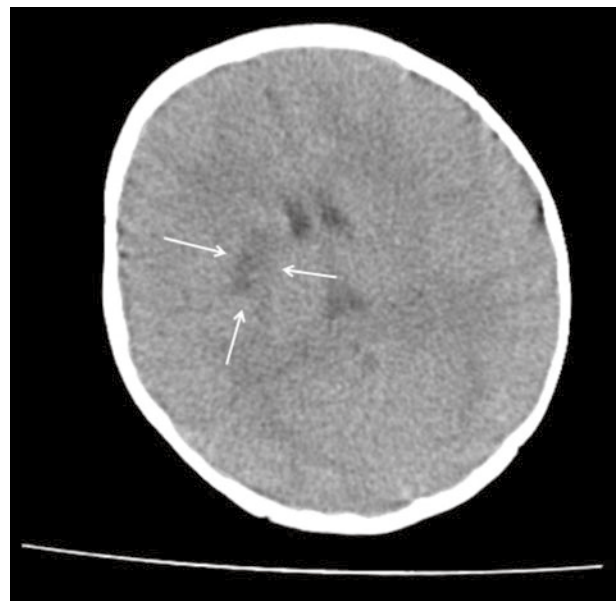
The patient discharged with outpatient follow-up. During the one week follow-up, he had a muscle power

of 3/5 in the left arm and 4/5 in the left leg. Furthermore, the father of the patient confirmed that his son had a normal ability in the left leg but an approximately 30% disability in the left arm in a telephone interview nearly one month later. He had also stated spasticity in his son's left hand.

## Discussion

Ischaemic stroke is a rare condition in childhood with an annual incidence rate of 7.91/100000. Although there are many risk factors for paediatric ischaemic stroke such as haematologic disorders and coagulopathies, vasculitis, systemic vascular disease, both congenital and acquired heart disease and vasospastic disorders, minor head trauma may also cause ischaemic stroke in childhood.<sup>2,3</sup>

Akinci et al reported a two-year-old patient suffered from acute ischaemic stroke resulting from a short distance fall. MRI showed periventricular hyperintensity in the lentiform and caudate nuclei on the right side, signs consistent with acute-subacute ischaemia.<sup>4</sup> Dharker et al described 23 children with hypodensity lesions in basal ganglia after minor head



**Figure.** The cranial CT scan displaying a hypodense lesion in the posterior limb of right internal capsule that was consistent with brain infarction.

injury between the age of 8 months and 6.5 years old. Only three patients had altered level of conscious after the injury, which lasted after a few hours. All the patients but one had complete recovery within four months. The lesions were predominantly located in the globus pallidus and extended toward the internal capsule.<sup>5</sup> Kieslich et al reported eight cases between 3 years 8 months and 7 years 8 months. All the patients had minor head injuries without skull fracture and the latency between the accident and neurological symptom, ranged from 15 minutes to 72 hours. The lesions were in the basal ganglia in five patients and in brain stem in three patients, supplied by the lenticulostriate branches of the middle cerebral artery, Heubner artery of anterior cerebral artery, thalamogeniculate branches of posterior cerebral artery and perforating branches of the basillary artery.<sup>6</sup> Unlike from the patients reported by Dharker et al, 6 of the 8 patients had neurological disability during the follow-up.<sup>5</sup> Rana et al reported seven patients between one month and 6 years with ischaemic stroke after minor head injuries. Most of the lesions were in basal ganglia and internal capsule. Although the long term follow-up of all patients had not been reported, two patients had a neurological sequel of minor disability and three were asymptomatic with upper motor neuron signs.<sup>7</sup> Shaffer et al reported five cases of ischaemic stroke following minor head injury between one and six years. None of the patients had loss of conscious after the trauma and only one of them had latency between the event and the development of the neurological symptoms. The neurological symptoms developed in a few minutes in the remaining four children. The lesions located in basal ganglia, lentiform nucleus, corona radiata and internal capsule. Three patients had complete recovery, however one patient had minimal pyramidal signs and the other had mild hemiparesis with expressive language difficulties.<sup>8</sup>

The pathophysiology of ischaemic stroke following minor head injury in childhood could be related to the anatomical characteristics of anterior perforating arteries, and end arteries. The perfusion of basal ganglia (caudate nucleus, putamen and globus pallidus) and internal capsule are provided by the lenticulostriate branches of the middle cerebral arteries. The angle at

which the perforating branches arise from the middle cerebral artery varies with age (more acute in childhood) of the individual and differences among the brain of children and adults. These end arteries follow a recurrent course before penetrating the anterior perforated substance. The minor head traumas with acceleration and deceleration may lead to the disruption of the arteries between the mobile extracerebral segment and fixed intracerebral portion. This disruption results with intimal trauma with subsequent thrombosis, mechanical disruption and spasm.<sup>9</sup> Maki et al described seven paediatric patients of minor head injury. Four of them had ischaemic brain infarct with basal ganglia lesions following minor head injury after latencies of between 15 minutes and 16 days.<sup>10</sup> The latency between the trauma and the development of the neurological symptoms could be described with the intimal injury followed by the progression of thrombus. The immediate development of symptoms might be related to mechanical disruption or vasospasm of the perforating arteries.

An interesting feature with ischaemic stroke following minor head injury is these patients are generally classified as low risk patients according to the guidelines about paediatric head trauma. Because of these patients are generally without loss of consciousness and symptoms after the event, these patients may be categorised as low risk patients and discharged even after a normal brain CT scan.<sup>2</sup> However, ED physicians should be alert when these patients return to the ED with neurological symptoms which could be due to the ischaemic stroke secondary to minor head injury.

The medical literature about ischaemic stroke following head trauma reveals a rare condition with some characteristic features. These characteristic features may be summarised as follows: minor head injury, to be in childhood, without loss of consciousness, a possible latent period between the accident and development of neurological symptoms, and gradual recovery. In conclusion, ischaemic stroke due to the minor head trauma is a rare condition. ED physicians may consider a possible ischaemic stroke in children presented with minor head trauma in history and by excluding the other conditions related to thrombotic events.

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