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CASE REPORT
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Rapid Ossification of Epidural Hematoma in a Child: A Case Report

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The author present a rare case of rapid ossification of epidural hematoma (EDH) in a 5-year-old boy. At admission, the computed tomography (CT) revealed an EDH on left temporoparietal region. On the follow-up CT scan doing 14 days after traffic accident, the expansion of the former hematoma was not visible, but the hematoma accompanied by the thin hyperdense layer on the dura. On follow-up CT scans, the hematoma was decreased but the ossified layer progressing. After 6 months of conservative therapy, the hematoma was fully absorbed and the ossified lesion merged to inner table of the skull. Hence, rapid ossification of an EDH should be considered in children and serial follow-up CT scans must be conducted.
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KEY WORDS: Ossification heterotopic · Hematoma epidural cranial · Computed tomography.

Introduction

Ossification of the epidural hematoma (EDH) has rarely been reported and the duration from head injury to it varied from 10 days to 40 years.[2,6,8-11] Ossification of chronic EDHs founded after trauma have been reported sometimes. A mass effect due to expansion of the hematoma accompanied by ossification can be one of the many causes of neurological impairment in patients who are being followed up with conservative therapy. However, rapid calcification or ossification in 1−2 weeks of EDH are very rare. Furthermore, in children, a few cases of ossified EDH has been reported.[11] The author present the very rare case of a 5-year-old boy with a rapidly ossified EDH, who had been treated conservatively.

Case Report

A 5-year-old boy was transferred from private clinic 1 day after traffic accident. He complained mild headache, but no any other neurologic deficit. He had scalp swelling and small laceration on left parietal region. A routine X-ray of the skull showed parietal fracture. The brain computed tomography (CT) on admission revealed left parietal EDH (Figure 1A). Because he had presented with no symptom, and the parents refused the operation, we did conservative therapy and waiting. A follow-up CT scan on 1 week later the EDH was slightly increased in volume (Figure 1B). The parents of patient refused operation. Two weeks later, brain CT showed that the EDH size was slightly decreased but high density line was revealed on the dural layer (Figure 1C). The patient didn't show any symptom like headache or seizure. The epidural calcification grew in thickness of first 2−3 months (Figure 1D and E). Six month after trauma, follow-up brain CT revealed that the EDH was fully absorbed, and the calcified lesion was merged to inner table of skull (Figure 1F). He had no metabolic or systemic disease. The results of laboratory analysis including complete blood count, serum electrolyte, serum glucose, liver and kidney function test, and coagulation tests were normal.

Discussion

EDH in children is a relatively rare condition because the dura firmly adheres to the inner table and the suture line of the

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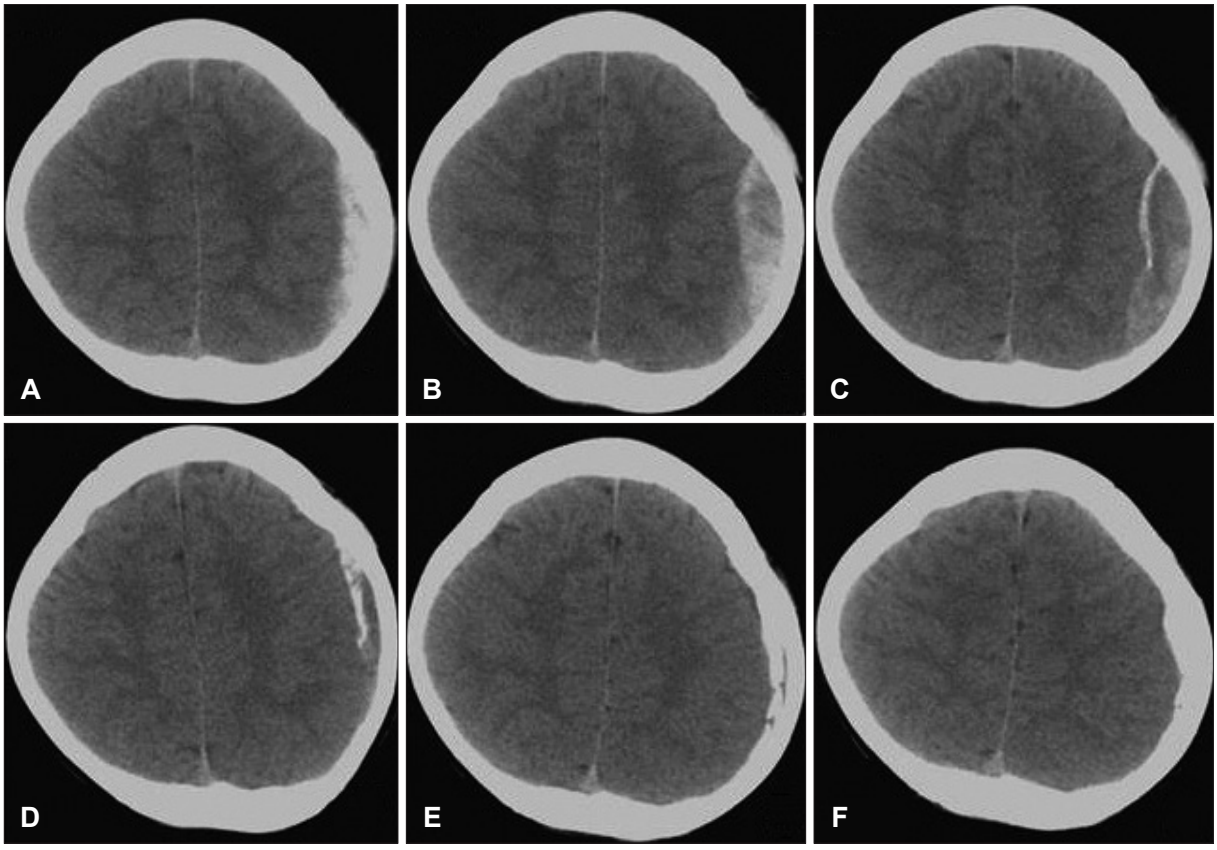

FIGURE 1. The progressive changes of epidural hematoma (EDH) and calcification on computed tomography (CT) scan. The brain CT on admission reveals left parietal EDH (A). A follow-up CT scan on 1 week later reveals the EDH that is slightly increased in volume (B). Two weeks later, CT scan shows that the EDH size is slightly decreased but a thick layer of calcification is revealed on the dural layer (C). The epidural calcification is growing in thickness of first 2–3 months (D, E). Six month after trauma, follow-up CT shows that the EDH has been fully absorbed, and the calcified lesion merged to inner table of skull (F).

skull. Rather than bleeding from the middle meningeal artery, which is found in adults, in children the cause of a hematoma can be a hemorrhage of venous blood, which takes longer to accumulate before it causes a significant mass. The small amount of EDH without neurologic symptom maybe cured with conservative treatment. In 50% of the EDHs there will be a slight increase in size between days 5 and 16, and some patients require emergency craniotomy when signs of elevated intracranial pressure occur. For this reason, management of EDHs in children requires very careful observation of the clinical course.[1)]

Since the introduction of CT scanning, ossified and/or calcified EDHs has rarely been reported as isolated cases in the literature.[2-9)] Rapid calcification and/or ossification in 1–2 weeks of an EDH are very rare clinical entities, although they can be seen at any stage of the conservative treatment or develop subsequently.[4,7)] In addition in the pediatric population, only a few cases of ossified EDH has been reported.[3,5,9)] Kawata et al.[5)] reported 2 pediatric cases with rapid ossification of an EDH, 4 months and 12 days after head injury, respectively. Nagane et al.[7)] reported an ossifying and calcifying EDH that was detected 40 years after a head injury. Shim et al.[9)] reported an ossified chronic EDH 73 days after head injury.

Although the precise mechanism of calcification of an EDH is still not well understood, we know that damage to vascularized tissues such as bones and the dura mater provokes tissue responses including inflammation, repair, and remodeling. This natural healing sequence is more rapid in children than adults. Erdogan et al.[3)] described the mechanism of ossification of an EDH in childhoods as phenomenon of excess tissue repair following acute injury. Mathuriya et al.[6)] have suggested that the clot may undergo fibrous organization and microscopic ossification, and infiltrated osteoblasts at the junction of the epidural granulation tissue and the dura may initiate ossification. Additionally, ossification may also result from repeated bleeding from the inner table of the skull. Shim et al.[9)] suggest that this ossification started at the periosteum, which was adherent to the bone at its margin and then grew over the entire periosteal

surface, because the patient was still in the formative years of continuous skull growth. Predisposing metabolic, hematologic, and endocrinological disorders could also contribute to ossification. In this case, the author could not demonstrate any abnormality that supports a metabolic bone disease or an endocrinological disorder by laboratory analyses and radiological examination.

According the investigators concerning to the pathogenesis of calcification, a fibroblast layer emerges adjacent to the dura at as early as 4 days after the bleeding, developing sinusoidal channel layers in 2 or 3 weeks, and then fibrous layers extend toward the cranial vault from the hematoma margin, subsequently forming connective tissue layers.[7] Because the outer layer of the dura is derived from the endosteum of the inner surface of the calvarium, stimulation of hematoma could actively evoke extradural ossification between the capsule and the dura.[4,6] This theories explain well the histopathologic status of the epidural shell in our case, because the inner shell was composed of a calcified capsule covered with a new bone layer outside and the outer shell included only the hematoma capsule with calcification under the normal skull.

In the presence of a calcification and/or ossification, because of possibility of clinical deterioration, should be observed with serial CT scans irrespective of their neurological deterioration. Kawata et al.[5] noted that rapid ossification may prevent absorption or resolution of an EDH and can cause neurological impairment due to mass effect. Shim et al.[9] suggested that surgical removal of the ossified EDH must be considered, even if the patient's condition is good, because this carries the risk of excessive bone calcification and ossification. However in this case, the EDH was absorbed without any problem and the ossification as merged to inner table on follow up CT. And as described above, there are several mechanisms of ossification that are dura mater or hematoma. However, there are limitations that are difficult to distinguish in this case, because no surgical procedure have been done.

Conclusion

The author report an 5-year-old boy with a very rare case of a rapidly ossified EDH, who had been treated conservatively without any problem and the ossification as merged to inner table of the skull. Hence, rapid ossification of an EDH should be considered in children and serial follow-up CT scans must be conducted even if the patient's condition is good. The author suggest that if ossified EDH induces no neurologic deficits, conservative treatment may be considered.

■ The authors have no financial conflicts of interest.

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