



Depressed Skull Fracture and Epidural Hematoma Resulted from Pin-Type Head Holder for Craniotomy in Children

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A head fixation device with pins is commonly used for immobilization of the patient's head during craniotomy. The safety of head fixation devices in children has been discussed rarely in the literature. We present one case of depressed skull fractures and associated epidural hematomas resulted from pin-type head holder for craniotomy in young children. The patient received surgical hematoma evacuation and recovered well after the surgery. The incidence of such complications reported in the literature is <0.65%. Age ranged from 2.6 to 7.5 years; all fractures were temporal and occurred during posterior fossa craniotomies. In conclusion, depressed skull fractures and associated epidural hematomas need to be considered as possible complications, while we use the pin-type head holder for craniotomy in children in the daily practice.

Key words: Skull clamp, skull fractures, epidural hematoma, pin related complication

INTRODUCTION

It is common knowledge among neurosurgeons that head pin fixation devices can cause skull fracture or perforation resulting in an epidural bleeding. This is especially true for pediatric patients in whom a thin skull predisposes to inadvertent skull injury. There are single case reports of air embolism, epidural hematoma, and a tension pneumocephalus related to pin fixation. There are a number of possible explanations for the paucity of reports in the literature: These complications are so common that their clinical importance are underestimated; and others are extremely cautious with the application of the head clamp in children and never thought that such complication would be related or these complications are reluctant to report.

CASE REPORT

This 6-year-old girl presented with 4 months history of intermittent morning headaches and vomiting. She presented

to our clinics due to progressive ataxia and unsteady gait for 2 months. Head computed tomography (CT) and magnetic resonance imaging scans revealed a posterior fossa mass [Figure 1a] with marked ventriculomegaly and the patient underwent a craniotomy for tumor resection. The child was placed in 3-point pin fixation with the Mayfield headrest using pediatric pins tightened to a pressure of 40 lbs. After placing the right side external ventricular drain, the tumor excision followed. During the surgery, the cerebellum was found to be swollen and despite the resection of the tumor and intermittent drainage of cerebrospinal fluid were performed, exposure of the tumor residual was still difficult. Furthermore, intraoperative CO₂ retention was informed. Eventually, partial removal of the tumor was done. No abnormalities were found upon removal of the Mayfield headrest. The patient wake up slowly, and a left-sided hemiparesis was noted. Moreover, decreasing blood hematocrit and refractory shock status developed. Blood components therapy and inotropic agent infusion were prescribed for the acute illness. An emergent CT scan revealed a large right sided epidural hematoma with a depressed fracture of the temporal bone, where the pin had been placed [Figure 1b and c]. Right fronto-temporal-parietal craniotomy for evacuation of the epidural hematoma was performed. After 1 week intensive care, the patient got stable and stationary neurological status presented after the surgery.

DISCUSSION

In the single reported case series by Lee *et al.*, there were five patients with complications related to the use of

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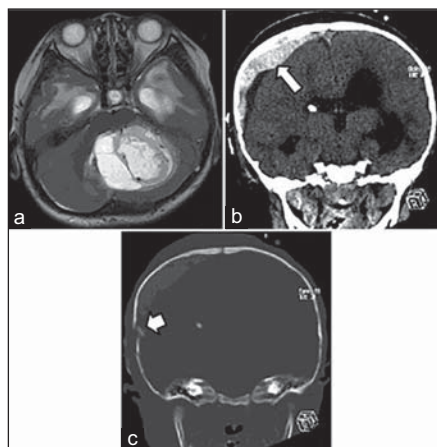


Figure 1. (a) Brain magnetic resonance imaging scans revealed a posterior fossa mass. (b and c) A postoperative emergent computed tomography scan revealed a large right sided epidural hematoma (long arrow) with depressed fracture of the temporal bone (short arrow), where the pin had been placed

the head pin holder.¹ Their age ranged from 3 to 8 years. In another series reported by Vitali and Steinbok,² the age range was from 2 years and 7 months to 6 years and 6 months. Furthermore, complications related to the pin head fixation device were related to the presence of a posterior fossa tumor, temporal application of the pins, prolonged surgery, presence of hydrocephalus, and age below 7 years. The most important factor for the skull fracture was the placement of the pin in normal, but relatively thin temporal squama. Based on our experience, if pin fixation is felt necessary, placement of the pins to avoid the temporal squama may avoid such complications.

The risk of the depressed fracture from pin fixation has to be balanced by the benefits of rigid fixation, and the risks of using other head rests, especially for prolonged operations, where there is a risk of skin damage by pressure from a headrest, such as a horseshoe headrest. The gel type of horseshoe headrests do allow prolonged positioning, even in the prone position without pressure necrosis, and if there is concern the head may be lifted periodically during the procedure. Unfortunately, some of them can cause skin pressure sores.^{3,4} Currently, we prefer a simple technique using a U-drape and a horseshoe headrest to stabilize the head in children under 3 years when frameless neuronavigation is being used.⁵

If one is going to use pins in a young child, it may be wise not to push suddenly to set the pins as is often done in adults, but to tighten gently to the planned pressure. A pressure of 40 lbs is generally adequate, and we have even used 30 lbs successfully. If there is a loosening of the head clamp or one hears the sound of a crack as the clamp is being tightened a depressed fracture should be considered. Besides, 4 pin system

is more safe than three pin-type according to the previous biomechanical study.⁶

If there have been no clues that a depressed fracture has occurred, one should consider that complication and the associated acute epidural hematoma, if there is unexplained and unexpected persistent hypertension or brain swelling during the operation, just like the illustrated case. In such a situation, checking the pin pressure reading and palpation of the pin sites under the drapes may provide information suggesting the presence of a depressed fracture. This may allow diagnosis prior to the eventual neurological deterioration.

It is not clear from the literature that there is an age above which pin fixations for craniotomy can be considered completely safe. The younger the child, the more concerned one would be about pin fixation, and we now would generally avoid pin fixation under 3 years of age, but it is important to recognize that a 3 years old cut-off is not based on scientific evidence. Indeed, most of the reported complications have occurred in children older than 3 years, which may reflect the fact that most surgeons avoid pins in younger children. Perhaps, if the temporal squama is avoided, pin fixation can be successfully used in children, even under 3 years of age. In such situations, it may be advisable to assess the skull thickness on CT scan before using a skull clamp with pins.⁷

CONCLUSION

Depressed skull fractures and associated epidural hematomas need to be considered as possible complications of pin fixation of the head for craniotomy in young children. Other possible complications include scalp lacerations, dural lacerations, vascular, and cortical injuries. Alternatives to pin fixation should be considered in the youngest children, especially <3 years of age. When pin fixation is required in young children, simple precautions may reduce the incidence of the complication and awareness of the complication may allow timely diagnosis and intervention.

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