

Traumatic subdural and subarachnoid hemorrhage following misuse of an inflatable bouncer in an infant: a case report and injury alert

Yuki Kimua-lai

Osaka Medical and Pharmaceutical Hospital

Mikio Kato

Osaka Medical and Pharmaceutical Hospital

Shuichi Shimakawa

`shuichi.shimakawa@ompu.ac.jp`

Osaka Medical and Pharmaceutical Hospital

Yutaka Odanaka

Osaka Medical and Pharmaceutical Hospital

Hikaru Tsuda-Kitahara

Osaka Medical and Pharmaceutical Hospital

Miho Fukui

Osaka Medical and Pharmaceutical Hospital

Kanta Kishi

Osaka Medical and Pharmaceutical Hospital

Akira Ashida

Osaka Medical and Pharmaceutical Hospital

Case Report

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Abstract

Background

Inflatable bouncers are widely used in recreational structures and the number of injuries associated with their use has increased in recent years. Most reported injuries involve the extremities; however, severe intracranial injuries are uncommon, particularly in infants. Inflatable dome playground structures, which are increasingly being installed in public parks, are generally considered safe; however, the injury patterns associated with their misuse remain insufficiently characterized. Herein we report a rare case of traumatic intracranial hemorrhage in an infant associated with the misuse of an inflatable bouncer, highlighting the importance of age restrictions and injury prevention.

Case presentation

: A 13-month-old girl was brought to the emergency department following a playground accident involving an inflatable dome. She was lifted and bounced by her caregiver and fell backward onto the surface after the caregiver released her hands. She cried immediately but subsequently became hypotonic and unresponsive. Upon arrival, her level of consciousness decreased. Neuroimaging revealed a left subdural hematoma and subarachnoid hemorrhage without parenchymal brain injury. Ophthalmological examination revealed bilateral retinal hemorrhage. No external signs of trauma or skeletal injuries were observed. The patient was treated conservatively and her neurological condition gradually improved. Follow-up imaging confirmed the resolution of the hematoma by day 22 of hospitalization.

Conclusions

This case demonstrated that severe intracranial injuries can occur in infants when inflatable bouncers are used outside the recommended age range. Despite their soft surfaces, inflatable structures are subjected to substantial impact forces. Increased awareness regarding age restrictions, supervision, and the safe use of inflatable playground equipment is essential to prevent similar injuries.

Background

Inflatable bouncers are air-supported recreational structures widely installed in playgrounds and amusement facilities. Along with their increasing popularity, injuries associated with inflatable bouncer use have been increasingly reported and have plateaued at a high rate since 2014 [1–3].

Previous epidemiological studies have shown that most inflatable bouncer-related injuries occur in children younger than 12 years, with a high proportion occurring in children under 6 years of age. Falls

are the most common injury mechanism, and reported injuries include fractures, sprains, and occasionally, head trauma [1–3].

Several safety recommendations for inflatable amusement devices have been proposed, including avoiding their use in children younger than 6 years, ensuring adult supervision, and minimizing situations that may lead to falls [1, 2, 4].

We report a rare case of traumatic intracranial hemorrhage in an infant following the misuse of an inflatable bouncer, highlighting the need for greater public awareness regarding age restrictions.

To the best of our knowledge, reports describing intracranial hemorrhage associated with inflatable dome playground structures in infants are extremely limited.

Case presentation

A 13-month-old girl was brought to the emergency department after a playground accident. She was born at 41 weeks of gestation with a birth weight of 3940 g. Her medical history included an atrial septal defect, pulmonary artery stenosis, and developmental dysplasia of the hip. Developmentally, she had achieved supported standing and had one meaningful word.

Prior to the injury, the caregiver reported that she had routinely engaged in play at home in which the child was gently tipped backward and allowed to land on her back on a soft surface such as a mattress.

According to the caregiver, on the day of injury, the child was lifted under the arms and bounced on an inflatable dome playground structure. When the caregiver released their hands, the child fell backward on the dome surface. The caregiver expected the surface to cushion the fall. However, the child fell backward and impacted her back and occiput on the inflatable dome surface, leading to a whiplash-like movement of the cervical spine. She cried immediately but subsequently became hypotonic and unresponsive, prompting the activation of emergency medical services.

On arrival, her vital signs revealed tachycardia and elevated blood pressure. Her level of consciousness was depressed, although partial improvement was observed during the initial management. Physical examination revealed no scalp hematoma, bruising, or skeletal injuries. The anterior fontanelle was flat. Computed tomography of the head revealed a crescent-shaped hyperdensity along the left frontoparietal region, consistent with a subdural hematoma (Fig. 1). Additional imaging suggested a subarachnoid hemorrhage without parenchymal brain injury (Fig. 1). Ophthalmological examination revealed bilateral retinal hemorrhage with a multiple-layered hemorrhage in the left retina (Fig. 2). The patient was conservatively managed with anticonvulsants and hemostatic therapy. Although transient somnolence and decreased responsiveness were observed during the first few days, her neurological status gradually improved. No surgical interventions were required. Follow-up imaging confirmed the resolution of the hematoma by day 22 of hospitalization.

Ethical approval

was waived for this case report in accordance with institutional policies. Written informed consent for the publication of this case report and the accompanying images was obtained from the patient's legal guardian.

Discussion and Conclusion

The present case report describes a rare instance of traumatic intracranial hemorrhage associated with the misuse of an inflatable bouncer in an infant. The patient developed subdural and subarachnoid hemorrhages after landing backward on an inflatable dome structure.

In infants, the skull is relatively compliant because the cranial sutures are not yet fused. This structural property may provide protection against abrupt increases in intracranial pressure during low-energy trauma such as falls from a low height. However, this may also result in reduced structural support for intracranial vessels, making them more susceptible to rupture, particularly the bridging veins. Furthermore, subdural hemorrhage is not strictly bleeding into a pre-existing "subdural space," but rather into a compartment within the dura. The dural vasculature is composed of thin-walled vessels adapted for fluid exchange, which may predispose them to leakage, resulting in hemorrhage within the dural layers [5]. These anatomical and physiological characteristics may explain how intracranial hemorrhage can occur even after minor trauma in infants.

Another important factor in this case is the patient's age. Inflatable amusement devices are generally intended for older children, and safety recommendations suggest avoiding their use in children younger than 6 years of age. In the present case, the device was used by a 13-month-old infant with caregiver assistance, which represents use outside the recommended age range and may have increased the risk of injury [1, 2, 4].

Previous studies reported that fractures associated with inflatable bouncers are primarily caused by collisions and falls. Falls, including those into or out of the bouncer [2, 6]. Notably, the proportion of injuries resulting from falls within or on the bouncer has been reported to be comparable to those occurring after falling onto a hard object outside the device [2, 6]. This finding suggests that despite the apparently soft surfaces of inflatable structures, substantial impact forces may be involved.

In the present case, the infant fell backward onto the dome surface, followed by immediate onset of neurological symptoms. Although the precise biomechanical mechanism remains unclear, these findings suggest that falls on inflatable structures may generate sufficient force to cause intracranial injury in infants.

The presence of subdural hemorrhage and retinal hemorrhages in infants raises concern for abusive head trauma, which represents an important differential diagnosis [7, 8]. However, these findings are not specific to abuse and may be observed in cases of accidental head trauma. In the present case, several findings supported an accidental mechanism. The injury occurred on a public playground with a clearly described and witnessed event. Physical examination revealed no external signs of trauma, and

neuroimaging revealed no parenchymal brain injuries. In addition, the clinical course was consistent with that of a single traumatic event and no evidence of repeated injuries was identified. The case was appropriately reported to the child welfare authorities, and no concerns regarding abuse were raised.

Inflatable dome playground structures, commonly referred to as “fuwafuwa domes” in Japan, have been increasingly installed in public parks and recreational areas. These devices have air-supported membrane structures that allow the children to bounce on their surfaces. Although they are generally regarded as safe play equipment, injuries may occur not only on the dome surface but also in the surrounding area because of the dynamic and unpredictable movements of the structure.

To date, most epidemiological reports on inflatable bouncer-related injuries have originated in Western countries and have primarily focused on commercial bounce houses or amusement facilities. Reports that specifically address inflatable dome playground structures installed in public parks are limited. Therefore, the present case provides additional insights into the potential injury patterns associated with this increasingly common type of recreational equipment.

This study has several limitations. In a single case report, a causal inference between the inflatable bouncer and intracranial hemorrhage could not be definitively established. However, the temporal association and consistent clinical findings suggest that injury is related to the reported mechanism.

From a public health perspective, this case highlights the importance of appropriate age restrictions and caregivers’ education. Inflatable play structures are often perceived as safe because of their soft and flexible surfaces. However, as demonstrated in this case, serious head injuries may occur when these devices are used outside the recommended age range. Increased awareness of its safe use and supervision may help prevent similar injuries.

Declarations

Ethics approval:

Ethical approval was not required for this single case report in accordance with institutional policy.

Consent to participate:

Not applicable.

Consent for publication:

Written informed consent for the publication of this case report and the accompanying images was obtained from the patient’s legal guardian. A copy of the written consent is available for journal review if requested.

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

YK-I and MK treated the patient as pediatric residents and prepared the manuscript. YO and KK treated the patients as pediatric cardiologists and prepared this paper. SS treated the patient as a pediatric neurologist and prepared the manuscript. H-TK and MF treated the patient in the same manner as pediatric neurologists. Professor AA provided accurate advice regarding the patients' treatment and this study.

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Figures

Figure 1

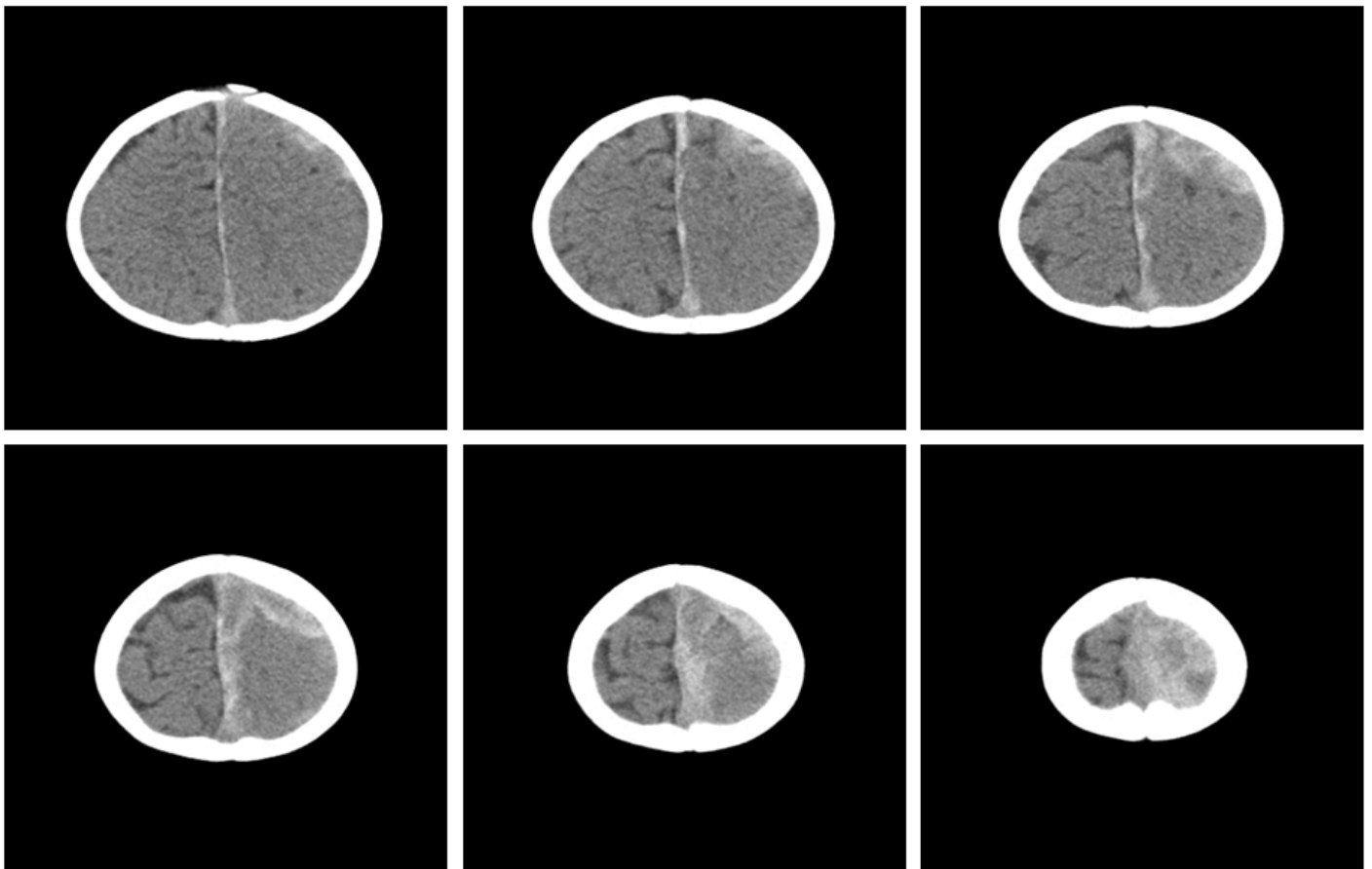


Figure 1

Head Computed Tomography showing cortical surface hyperdensities in the left occipital and left frontoparietal regions, along with a crescent-shaped hyperdensity in the left frontoparietal area, indicative of left subdural and subarachnoid hemorrhages.

Figure 2

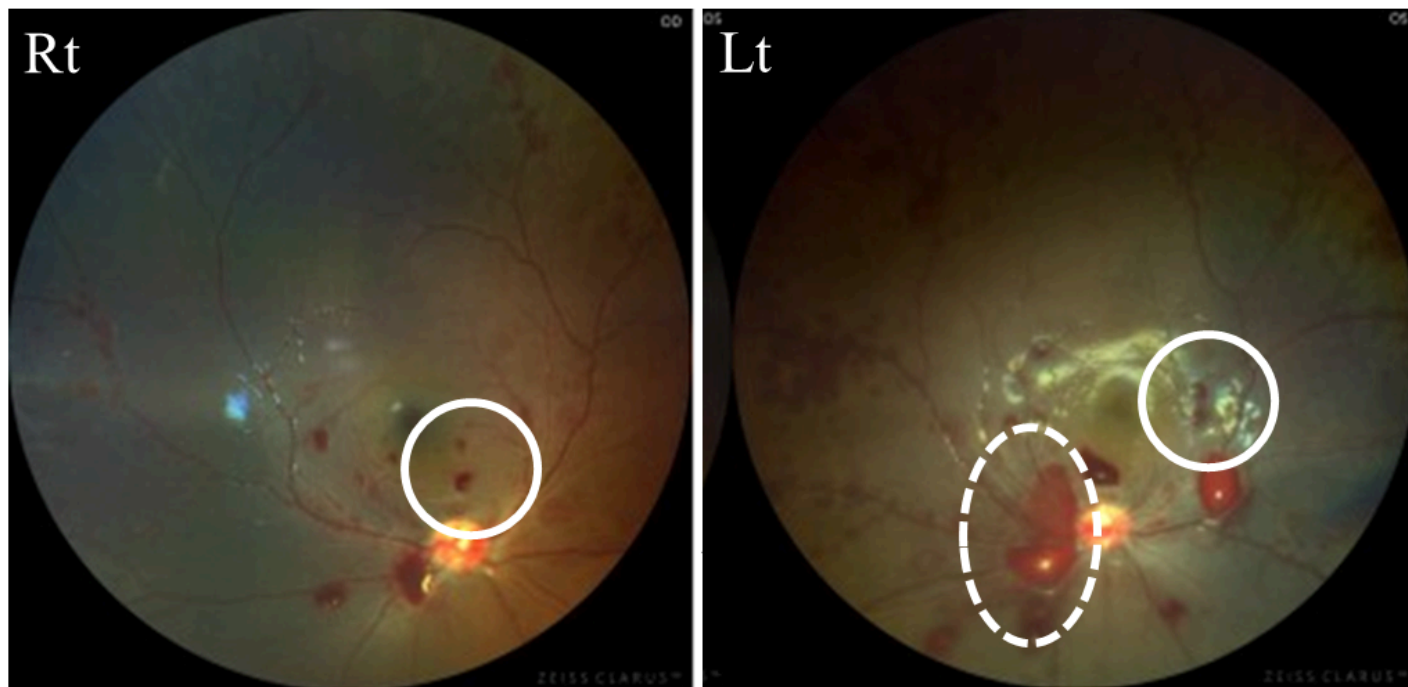


Figure 2

Bilateral retinal hemorrhages (solid outlines). A pre-retinal hemorrhage with a boat-shaped appearance and horizontal blood level is present in the left eye (dashed outline).