



Congenital depressed skull fracture (“ping-pong” fracture) in newborn infants as a differential diagnosis of physical abuse

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ABSTRACT

Depressed skull fractures without a clear explanation as to their origin point to trauma with a blunt object and suspected child abuse. In the case of newborn infants, their young age is a vulnerability factor and requires an exhaustive assessment. When child abuse is suspected, an assessment of the differential diagnoses is required to make the most appropriate intervention possible. Both an excessive intervention and an omission of a necessary intervention should be avoided. Congenital depressed skull fractures, described as “ping-pong fractures”, are rare (0.3 to 2/10 000 births). They may appear without any trauma history or in instrumentalized childbirth. Here we describe the case of a newborn infant with a ping-pong fracture as an example of an accidental fracture.

Keywords: *depressed skull fracture; congenital; closed reduction; child abuse; newborn infant.*

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INTRODUCTION

Depressed skull fractures without a clear explanation as to their origin point to trauma with a blunt object and suspected child abuse.^{1,2} Attempts should be made to determine the mechanism of the fracture and whether it was accidental or intentional. In relation to its assessment, a changing account by caregivers, a description of the mechanism of the fracture that is not consistent with the injury or the absence of an explanatory account, a delay in consultation, the young age of the child, and the neurological development of the child that does not coincide with the account of the injury are indicators that point towards the diagnosis of physical abuse.^{1,3,4} Abusive head trauma, which includes shaken baby syndrome, is the leading cause of mortality due to child maltreatment.⁵⁻⁷ In addition, it is worth taking into account the differential diagnoses of these injuries.^{1,3,4} Both the absence of intervention

in a case of maltreatment and an excessive intervention in the case of unintentional injuries would be detrimental. In newborn infants, their young age is in itself a factor of vulnerability considering their degree of defenselessness and great dependence on parental care. Here we describe the case of a newborn infant with an accidental fracture (ping-pong fracture) as a differential diagnosis of intentional fractures.

CASE REPORT

The Department of Neonatology requested a consultation with the Unit of Family Violence of Hospital General de Niños Pedro de Elizalde in relation to a 6-day-old baby girl referred from a hospital in Florencio Varela for the reduction of a depressed skull fracture in the right parietal bone (*Figure 1*). It was reported that the mother had not noticed the injury on her baby's skull, but that a family member had warned her. The patient

FIGURE 1. Skull x-ray, front view



Skull fracture-depression in the right parietal region.

stayed at the hospital at all times.

She was a term infant born at 41 weeks of gestation from a controlled pregnancy with negative serology; she had a birth weight of 3250 g, an Apgar score of 9/10, a head circumference of 32.5 cm, and no other signs or symptoms. According to the reports and medical history, she was born via a C-section due to previous maternal C-section, with no family, personal, or traumatic history. The ancillary tests did not show parenchymal lesions. The brain ultrasound was normal; the computed tomography scan of the brain showed a right parietal depression that measured 26 mm long and 3.7 mm deep, with no solution of continuity of the bone (*Figures 2 and 3*). Both the neurological and vision assessments were normal. The Department of Neurosurgery performed a fracture reduction by suction using the MARS method.⁸

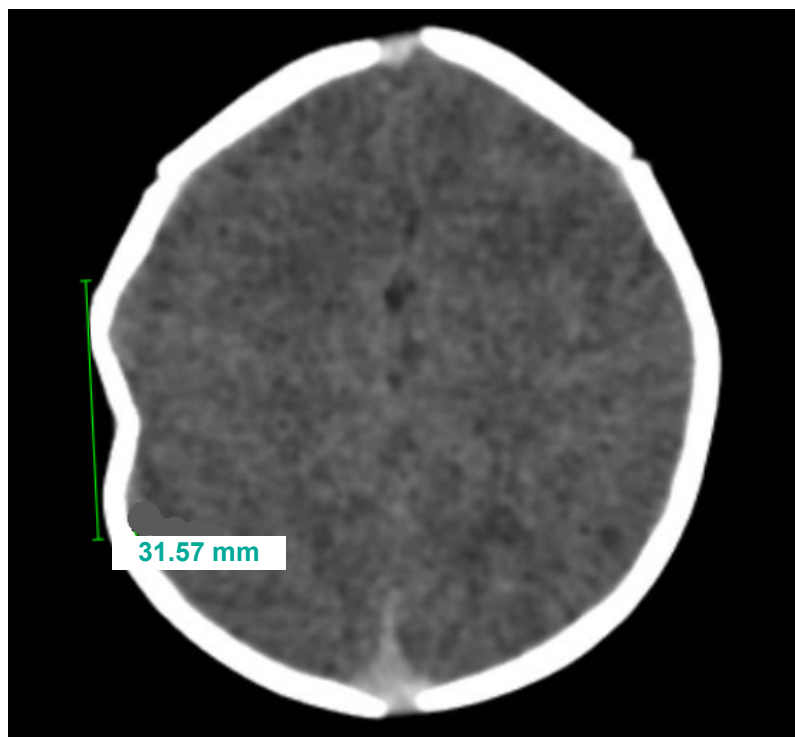
In relation to the approach by the Unit of Family Violence, an initial interview was conducted with the patient's mother (28 years old), who lived with her baby's father (29 years old) and her siblings (11 years old and 3 years and 20 months old). The family lived on the same property as the maternal

grandmother and a great-aunt; both assisted them with care. During the interview, the mother was cooperative and concerned about her daughter's health. She mentioned a feeling of guilt regarding the injury for having "endured the contractions," relating it to her desire to give birth by C-section and, thus, have a tubal ligation in the same surgical procedure. She acknowledged noticing the injury when one of the baby's maternal aunts pointed it out to her. The mother mentioned having a family support network. Other family members of the patient were also interviewed. No risk indicators of suspected child abuse were found in the examination.

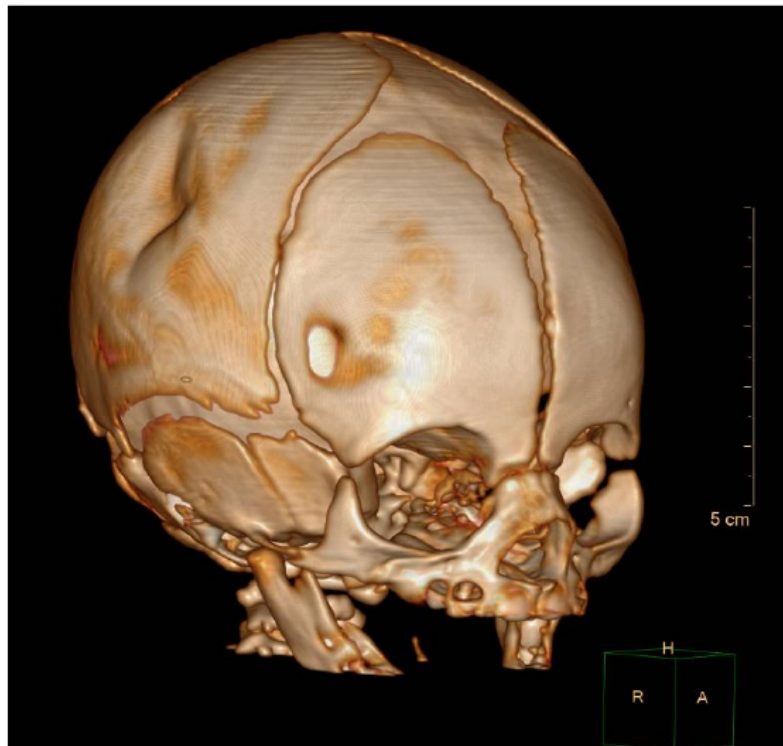
DISCUSSION

The ping-pong fracture is a depressed skull fracture in the shape of a cup which, in general, does not present a solution of continuity and is congenital in appearance. According to the bibliography, it is uncommon, with a prevalence of 0.3 to 2 per 10 000 births.^{9,10} This may be an iatrogenic fracture that occurs during a traumatic vaginal delivery or C-section due to the use of forceps or exposure of the baby's skull to great

FIGURE 2. Computed tomography scan of the brain



Depressed skull fracture in the parietal region, with no solution of continuity of the bone and no intracranial injury.

FIGURE 3. 3D reconstruction of computed tomography scan

3D reconstruction of the bone window, depression was similar to a dented ping-pong ball.

pressure during delivery or C-section. However, it may also appear spontaneously without a history of traumatic events; it may occur by continuous and focal compression of the baby's malleable skull against certain bony structures or structural configuration of the environment (ischium, sacral promontory, pubic symphysis, uterine fibroids, fifth lumbar vertebra, the baby's own hands, a body part of a twin in a multiple pregnancy, asymmetrical pelvis). In general, ping-pong fractures involve the frontal, parietal, and occipital regions. Complications include subdural or epidural hematomas, cerebral contusions, parenchymal lesions, or neurological sequelae, especially in compound depressed fractures.¹¹

Regarding their management, the decision on the procedure corresponds to the neurosurgeon; conservative and expectant management may be considered in the case of simple and shallow fractures, which may resolve spontaneously. In other cases, such as that of the patient described here, the manual aspiration reduction system (MARS) can be used, a simple suction method that is accessible, effective, safe, low-

cost, and non-surgical.⁸ In the case of more complex fractures, surgical treatment by craniotomy may be required.^{9–13}

Ilhan described the case of a male infant born at 39 weeks of gestation with a birth weight of 3250 g from a controlled pregnancy and with no history of trauma. At birth, he had an Apgar score of 8/9, a skull circumference of 35 cm (p 50–75) and a depression in the right parietal region that measured 3 × 3 cm and had a depth of 4 mm without other signs or symptoms. A conservative management was decided with longitudinal follow-up and spontaneous resolution.¹¹

Silva published a similar case with a greater fracture depth (4 × 3 cm with a depth of 2 cm) managed conservatively.¹² Preston described the case of an infant born at 38 weeks of gestation via an emergency C-section following a failed drug induction for maternal preeclampsia. The case history noted that the mother had a vomiting period and a fall to her knees that did not require consultation or intervention 10 days prior to the birth. At birth, the baby had an Apgar score of 6/7/9, a birth weight of 3240 g, and

a head circumference of 33.5 cm (p 3–10). He had a depression in the temporoparietal region that measured 3 × 3 cm with a depth of 2 cm, no neurological alterations or other signs or symptoms. An expectant management was decided, and the fracture resolved spontaneously.¹⁰

Depressed skull fractures caused by blows against a blunt object, such as a hammer, cause a solution of continuity of the bone, are usually associated with intracranial injuries, and require surgical resolution,^{2,14} unlike simple ping-pong fractures, which do not have these characteristics. In the case of suspected abuse in newborn infants, their young age is a factor of vulnerability and requires an exhaustive examination to prevent any excessive intervention or the omission of a necessary intervention. Here we described the case of a 6-day-old newborn infant with a depressed skull fracture. Her caregivers could not explain the injury, which was to be expected, given that the fracture would be congenital or secondary to delivery procedures. A fracture with parietal collapse of the skull without solution of continuity and without intracranial injury suggests an accidental injury. The family was assessed, and no risk factors for child abuse were observed. The newborn infant had not been discharged from the hospital prior to diagnosis, making it unlikely that an assault was undetected by the treating healthcare team.

The objective of this report was to communicate that, while depressed skull fractures are indicative of a diagnosis of physical abuse, congenital ping-pong fractures occur as a result of an accidental mechanism. These fractures require examination by the neurosurgeon, although in most cases their resolution is not surgical. ■

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REFERENCES

1. Garrote N, Indart de Arza MJ. Maltrato físico. In Garrote N. *Maltrato infantil. Aportes para su detección, abordaje y prevención*. Buenos Aires: Journal; 2018:35-9.
2. Hobbs CJ. Skull fracture and the diagnosis of abuse. *Arch Dis Child*. 1984;59(3):246-52.
3. Christian CW, Committee on child abuse and neglect, American Academy of Pediatrics. The evaluation of suspected child physical abuse. *Pediatrics*. 2015;135(5):1337-54.
4. Adamsbaum C, Billete de Villemeur T, Husson B. Non accidental injuries of the brain and spinal cord. In Rey-Salomon C, Adamsbaum C (eds). *Child abuse. Diagnostic and forensic considerations*. Cham: Springer; 2018:105-40.
5. Blumenthal I. Shaken baby syndrome. *Postgrad Med J*. 2002;78(926):732-5.
6. Theodorou CM, Nuño M, Yamashiro KJ, Brown EG. Increased mortality in very young children with traumatic brain injury due to abuse: A nationwide analysis of 10,965 patients. *J Pediatr Surg*. 2021;56(6):1174-9.
7. Narang SK, Fingarson A, Lukefahr J, Council on child abuse and neglect. Abusive Head Trauma in Infants and Children. *Pediatrics*. 2020;145(4):e20200203.
8. Minghinelli F, Recalde R, Socolovsky M, Houssay A. A new, low-cost device to treat depressed "ping-pong" fractures non-surgically. *Childs Nerv Syst*. 2021;37(6):2045-9.
9. García Reymundo M, Real Terrón R, Sáez Díez I, Piñán López E. Fractura craneal deprimida congénita: ¿actitud a seguir? *An Pediatr (Barc)*. 2015;83(3):219-20.
10. Preston D, Jackson S, Gandhi S. Non-traumatic depressed skull fracture in a neonate or 'ping pong' fracture. *BMJ Case Rep*. 2015;bcr2014207077.
11. İlhan O, Bor M, Yukkaldiran P. Spontaneous resolution of a 'ping-pong' fracture at birth. *BJM Case Rep*. 2018;bcr2018226264.
12. Silva JB, João A, Miranda N. Ping-pong fracture in newborn: a rare diagnosis. *Acta Med Port*. 2019;32(7-8):549.
13. Ballesteros MF, De Oliveira RS. Closed depressed skull fracture in childhood reduced with suction cup vacuum method: case report and a systematic literature review. *Cureus*. 2019;11(7):e5205.
14. Fernández-Jaén A, Calleja-Pérez B, García-Asensio JA. Traumatismo craneoencefálico en la infancia. *Medicina Integral*. 2001;37(8):337-45.