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CASE REPORT

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# A parietal bone fracture with subgaleal and subdural hemorrhage in association with vacuum extraction delivery

**Giovanna Marchini**[1] | **Daniel Martín Muñoz**[2] | **Ylva Vladic Stjernholm**[3]

[1]Departments of Neonatology, Karolinska University Hospital and Karolinska Institutet, Stockholm, Sweden

[2]Department of Neuroradiology, Karolinska University Hospital and Karolinska Institutet, Stockholm, Sweden

[3]Women's and Children's Health, Karolinska University Hospital and Karolinska Institutet, Stockholm, Sweden

**Correspondence**
Ylva Vladic Stjernholm, Women´s and Children´s Health, Karolinska University Hospital and Karolinska Institutet, Stockholm, Sweden.
Email: ylva.vladic-stjernholm@sll.se

**Key Clinical Message**

A neonatal parietal bone fracture was complicated by subgaleal and subdural hematomas after a vacuum extraction delivery. Low-dose computer tomography visualized a comminuted skull fracture. Close observation of infants delivered by vacuum extraction, conservative management after a skull fracture, and further studies on vacuum traction monitoring are warranted.

**KEYWORDS**

comminuted fracture, hematoma, neonate, vacuum extraction

## 1 | INTRODUCTION

Instrumental delivery is associated with increased fetal stress[1] and with an increased rate of fetal injury[2,3] compared with normal delivery. Skull fractures and intracranial bleedings have been reported after instrumental delivery, particularly in cases of complex procedures combined with precipitous delivery, prolonged second stage of labor and macrosomia.[4]

## 2 | CASE PRESENTATION

We report a case of a male infant with normal weight 3780 g delivered at a normal gestational age 39 weeks by a previously healthy primiparous woman. Instrumental delivery using vacuum exctraction (VE) was carried out due to a prolonged second stage of labor lasting 4 hours. The fetus was in an occiput anterior presentation with the vertex 1 cm above the perineum. A 50-mm Bird metal cup was placed on the fetal head and a negative pressure was applied within 2 minutes until 0.8 kg/cm$^2$. The extraction procedure was described as easy, necessitating 4 traction pulls without any detachment, and lasting 12 minutes. The delivery was considered uncomplicated.

Apgar scores were 6, 10, and 10, umbilical arterial pH was 7.22 and umbilical base excess (BE)—6 mmol/L. The neonate received bag valve mask ventilation for <1 minute. The neonate received an injection of Vitamin K 1 mg at birth according to standard practise. Three hours after birth, he was assessed for swelling over the left frontoparietal area including the upper eyelid with a prominence of the left side of the skull and a subgaleal hematoma on the same side. Ultrasound investigation of the head revealed a left sided depressed parietal bone fracture and a small cephalohematoma. Other intracranial structures were normal. The baby was neurologically intact, with unremarkable physical examination findings and good sucking ability. At 2 days of age, the baby was found to be pale with hemoglobin of 131 g/L and a hematocrit of 36%. Coagulation factors were normal for the baby and the mother. Low dose computer tomography (CT) investigation of the head (Siemens Somatom Force) and 3D volume rendering with Advantage Windows 4.7 (General Electric, Milwaukee, WI, USA) demonstrated a 5-cm L-shaped comminuted fracture in the left parietal bone extending from the anterior sagittal suture into the left

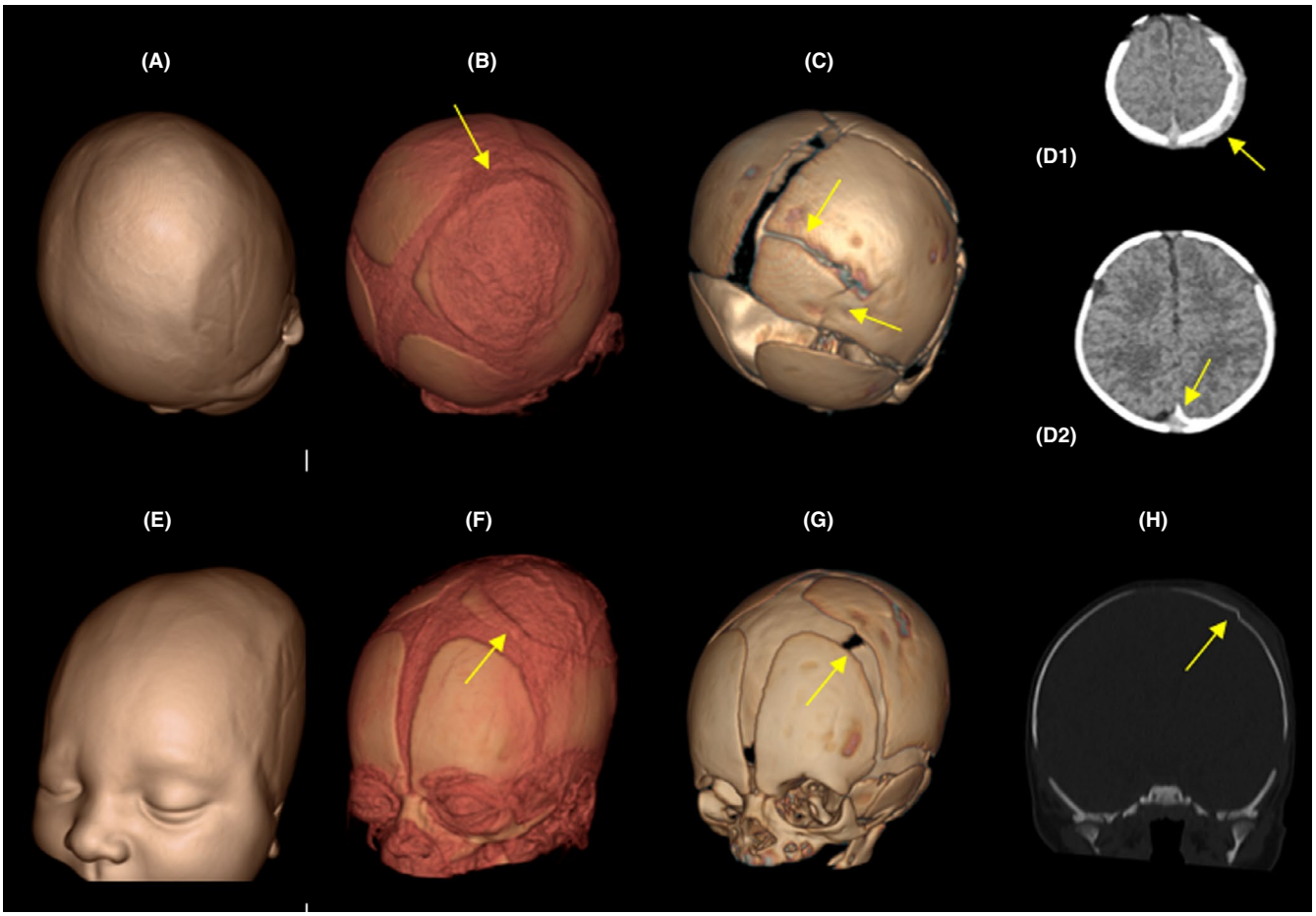


**FIGURE 1** Computer tomography 3D images of neonatal head demonstrating the area of Bird metal cup attachment at an anterior occiput asynclitic presentation, cranio-caudal view (A-C), and left oblique frontal view (F-G). Soft tissue window visualizing rim of cup in relation to subgaleal hematoma (B and F) and parietal L-shaped bone fracture in relation to skull sutures (C and G). 2D brain window: normal brain parenchyma, left subgaleal hematoma (D1) and left posterior parietal subdural hematoma abutting superior sagittal sinus (D2). 2D coronal bone window (H):displaced, depressed comminuted parietal skull fracture

limb of the coronal suture. A 5.5 × 4.5 cm subgaleal hematoma was identified along with a minimal subdural hematoma extending along the left posterior falx and superior sagittal sinus, as shown in Figure 1A-I.

Hemoglobin levels remained stable during the following 3 days. Clinical examination was normal apart from the subgaleal hematoma. The baby was discharged at 6 days of age. A recheck at 3 weeks of age confirmed a normal neurologic examination, without any remaining hematoma or swelling of the head and a stable hemoglobin level.

## 3 | DISCUSSION

Superimposing the CT scan with the positioning of the vacuum extractor cup on the infant´s head revealed that the fracture was located in the central part of the cup area (Figure 1A-C,F-H).

The fetal skull bones are very thin, <1 mm, and with various thicknesses. The thinnest areas are visible as dark round spots (Figure 1C,H). Thus, the distribution of the traction force on the fetal head at VE delivery could per se be sufficient to cause a skull fracture under certain circumstances. Additional factors contributing to the risk of fetal head injury could be an asynclitic presentation with suboptimal attachment of the vacuum extractor device, as in this case (Figure 1A,B,F,G). Another risk factor is the traction force used by the physician. A recent study has shown that the delivering physician tends to underestimate the traction force, which may expose the fetus to a higher traction force than assumed.[5]

Linear skull fractures in neonates generally heal without treatment, but may rarely evolve into growing fractures, which are thought to be caused by an associated dural tear with herniation of leptomeninges and pulsation of cerebrospinal fluid into the fracture diastasis.[6]

The traction force used during VE delivery pulls the Galea aponeurotica from the skull periosteum, thus causing hemorrhage of the numerous and large bridge veins connecting dural sinuses and scalp veins. This subgaleal space extends from the orbital margin anteriorly, the temporal fascia laterally and the nucal ridge posteriorly and has a volume capacity of up to 260 mL in term infants, which is equivalent of the baby´s almost entire blood volume. The mortality rate of such a hemorrhage is nearly 25%[7] and a drop of >25% in hematocrit combined with asphyxia are the main risk factors for neonatal death.[8]

Vacuum extraction delivery has a success rate more than 90% for synclitic presentation.[9] Most VE deliveries are performed due to prolonged labor, which has been defined as a second stage lasting 3 hours or more in primiparous women and 2 hours or more in parous women.[10] A multicenter randomized study investigated 4126 primiparous women who reached the second stage of labor, which lasted up to 5 hours. None of the neonatal adverse outcomes of Apgar score of <4 at 5 minutes, umbilical artery pH <7.0, intubation in the delivery room, need for admission to the neonatal intensive care unit, or neonatal sepsis was related to the duration of the second labor stage.[11] However, other studies report an increased prevalence of neonatal complications such as asphyxia, intracranial hemorrhage grades 3-6 and seizures after VE compared with spontaneous vaginal delivery.[2,12,13] A traction procedure lasting for more than 10 minutes is related to a higher rate of neonatal adverse outcomes as compared to traction of shorter duration. A retrospective study between 1990 and 2005 in Sweden of 472 cases of delivery-related neonatal asphyxia, found that a vacuum extraction exceeding 20 minutes was utilized in 19 cases (4%).[14] New CT scanner technique with lower radiation doses preserve image quality. The total radiation dose used for a CT skull is 0.3 mSv and for a CT head 1 mSv, compared with an average of 4 mSv 10 years ago at our institution. This should be compared to the valuable information of possible of intracranial findings not identified with plain films and CT of the skull.

In this case, the new low dose CT technique showed the fracture site in relation to the nonoptimal asynclitic VE metal cup position, to our knowledge for the first time.

## 4 | CONCLUSION

Fetal head injuries in association with VE delivery could be more frequent that previously reported. CT investigation of the neonate´s head should be considered if clinical symptoms or laboratory signs of hemorrhage or unclear neurological findings are noted. Close observation of infants delivered by VE, conservative management after a skull fracture with hematomas and further clinical studies on vacuum traction monitoring are warranted.

## CONFLICT OF INTEREST

None declared.

## AUTHOR CONTRIBUTION

GM and YVS: collected clinical data and drafted the manuscript. DMM: performed and interpreted the CT skull investigations. The cased report was improved by all authors.

## ORCID

*Ylva Vladic Stjernholm* https://orcid.org/0000-0003-3414-6668

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