Caput Succedaneum and Cephalohematoma: The Cs that Leave Bumps on the Head

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ABSTRACT

Caput succedaneum and cephalohematoma are conditions that rarely evoke much concern in the NICU but deserve more attention. This article examines the two conditions, reviews the literature, discusses possible complications, and leaves the reader with a heightened awareness of these seemingly benign lesions.

BIRTH INJURIES TO THE HEAD OCCUR BECAUSE THE HEAD IS particularly vulnerable to trauma during the forces of labor exerted during vertex deliveries. Caput succedaneum and cephalohematoma are the most common types of birth injuries to the head. Caput succedaneum is a collection of edematous fluid above the periosteum between the outermost layer of the scalp and the subcutaneous tissue. It is a common lesion seen at birth. Cephalohematoma is a subperiosteal accumulation of blood that occurs infrequently, with an incidence of 0.4–2.5 percent of all live births.[1]

CAPUT SUCCEDANEUM

Caput succedaneum is most commonly seen on the presenting portion of the infant's skull during a vaginal birth. The swelling is formed from the high pressure exerted on the infant's head during labor by the vaginal walls and uterus as the head passes through the narrowed cervix.[1] This prolonged tension causes serosanguineous fluid to leak from the subcutaneous tissue into the area above the periosteum between the scalp and the lining of the periosteum with resultant edema and/or bruising. This location results in a collection of fluid that crosses over the cranial sutures (Figure 1).

Although caput succedaneum may occur in the absence of risk factors, incidence increases in difficult or prolonged labors, with premature rupture of the amniotic membranes (where amniotic fluid is not available to cushion the skull during labor), in primagravidas, and in instrument-assisted deliveries. During vacuum-assisted delivery, the point at which the cup is attached to the head yields a vacuum caput. As vacuum pressure is applied and pulling force is exerted on the head, swelling occurs secondary to the trauma. This type of caput is called a *chignon*, or artificial caput succedaneum.[2]

Several cases of caput succedaneum diagnosed in the third trimester by ultrasound have been described in the literature. In most of the prenatal descriptions, fetal position, oligohydramnios, and possibly Braxton Hicks contractions have been identified as causative factors.[3–5]

Clinical Manifestations

The caput succedaneum is evident immediately following delivery and gradually decreases in size thereafter. It is most commonly seen on the vertex of the head.[6] The caput is generally 1–2 cm in depth and varies in circumference.[1] On physical examination, it has a soft, boggy feel with irregular margins, and it may have petechiae, purpura, and/or an ecchymotic appearance. The collection of serous fluid shifts from side to side as the infant's head position is changed. In rare cases of vacuum-assisted delivery, the skin breaks when the vacuum cup "pops off" of the head and abrades the underlying skin.[2]

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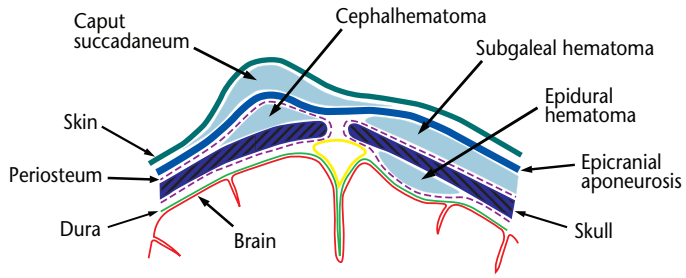
FIGURE 1 ■ Diagram of the infant scalp showing the locations of the common hematomata of the scalp in relation to the layers of the scalp.



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Possible Complications

Halo scalp ring, a type of alopecia, may occur in infants with a caput succedaneum. The hair loss develops as a result of tissue necrosis from prolonged pressure against the ring of the cervical os during the birthing process. In most cases, hair grows back over time, but scarring and hair loss are sometimes permanent. Tanzi and colleagues believe that this condition is common, but that it is underrecognized and therefore underreported in the pediatric literature.[7]

CEPHALOHEMATOMA

Cephalohematoma, sometimes called cephalhematoma, is a collection of serosanguineous or bloody fluid below the periosteum of the skull. Cephalohematoma occurs twice as often in males as in females, for unknown reasons. It is more common in primagravidas, in large infants, following instrument-assisted deliveries (with vacuum or forceps), following prolonged difficult labor, when cephalopelvic disproportion exists, when the head is in a deviant position (occipital posterior, occipital transverse), or when a scalp electrode has been placed.[1,8] These risk factors contribute to the traumatic impact of the birthing process on the head and are well documented in the literature.

Cephalohematoma is an injury that results from trauma to the skull as it is forcefully and repeatedly compressed against the pelvic bones with contractions during labor. This shearing action causes bleeding of the emissary and diploic veins into the subperiostial layer of the skull (Figure 2). The bleeding slowly lifts the periosteum away from the skull and is contained by the ligaments that attach the periosteum to the skull at the cranial suture lines. Cephalohematoma occurs in a deeper, more vascular portion of the scalp than caput succedaneum, which accounts for the increased blood content of a cephalohematoma, as depicted in Figure 2. Although most cephalohematomas occur secondary to trauma, they have been diagnosed *in utero* by prenatal ultrasound and have been reported in neonates born via cesarean section without labor.[5,8,9] Petrikovsky and colleagues suggest that these cephalohematomas may be caused by fetal head position *in utero,* head compression by the uterine walls in the case of oligohydramnios, or premature rupture of the membranes.[5]

Clinical Manifestations

Because of the slow nature of subperiostial bleeding, cephalohematomas are not usually present at birth but develop hours or even days after delivery.[1] As the bleeding continues and blood occupies the subperiosteal space, pressure in this area builds and acts as a tamponade to stop further bleeding. A firm, enlarged unilateral or bilateral bump covering one or more bones of the scalp characterizes the lesion. The mass cannot be transilluminated.[10] The overlying skin is usually not discolored. Cranial sutures clearly define the boundaries of the cephalohematoma, although a caput succedaneum or scalp swelling overlying the cephalohematoma can obscure those boundaries. The parietal bones are the most common site of injury, but a cephalohematoma can occur over any of the skull bones. The right parietal bone is involved twice as often as the left, with unilateral five times as likely as bilateral parietal bone involvement.[11,12] The literature is not clear as to why the right side is more frequently involved than the left, but it may be because the right side is positioned to absorb more of the impact. The infant may be sensitive to palpation of the cephalohematoma, especially in the case of an underlying skull fracture.[13]

Possible Complications

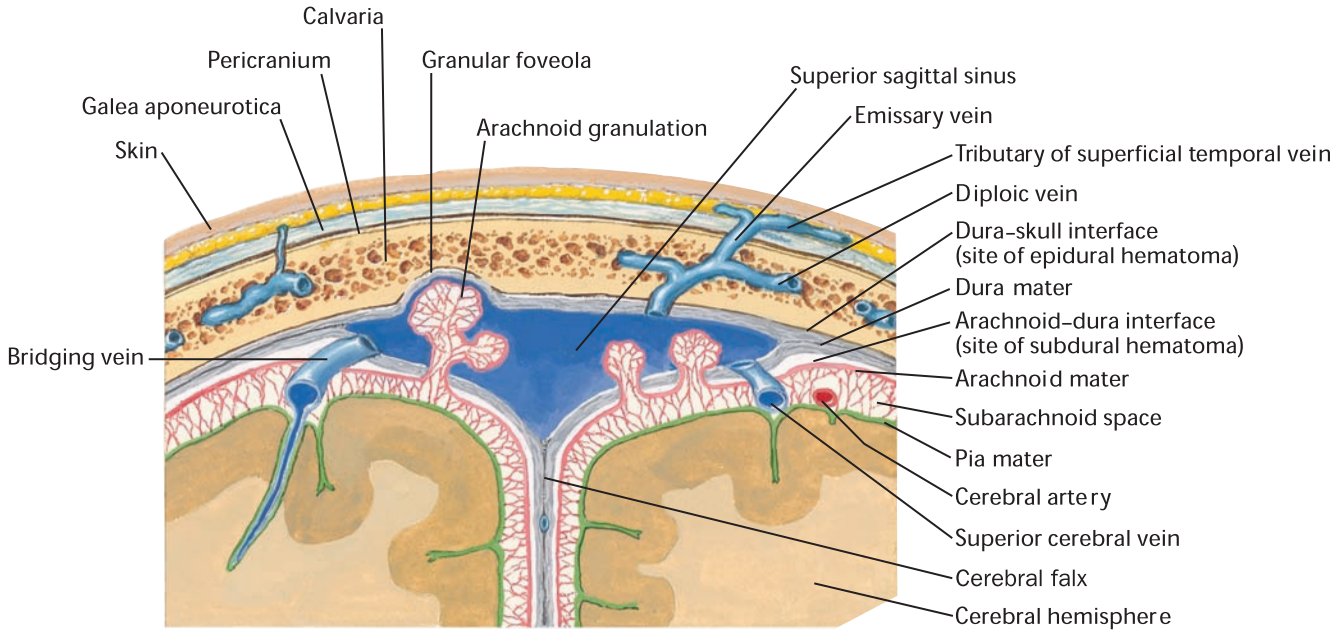
Skull Fracture. Linear skull fractures occur in about 5 percent of unilateral[8,10] and about 18 percent of bilateral cephalohematomas.[10] In 1952, Kendall and Woloshin reported that underlying fractures occurred in 25 percent of infants with cephalohematomas.[11] No relationship has been made between the size of the cephalohematoma and presence or absence of a fracture. Routine x-rays are not recommended, but should be obtained when the cephalohematoma is excessively large, when central nervous system symptoms are present, or when an extremely difficult delivery has taken place.[14] Linear skull fractures usually do not require treatment.[1]

Calcification. On rare occasions, a cephalohematoma persists beyond four weeks and begins to calcify. Petersen and colleagues report on two cases of cephalohematomas in infants that calcified and caused misshapen heads.[15] Chung and coworkers refer to this process as subperiostial osteogenesis. Although rare, calcified or ossified cephalohematomas may cause significant deformities of the skull requiring treatment.[13] Calcification occurs as a result of calcium deposits in the area.[1,10] The mechanism of nonreabsorption is not evident in the literature, but size of the injury might enter into the ability of the body to reabsorb all of its contents.

Infection. If an infant presents with signs and symptoms of sepsis and the focus of sepsis cannot be explained, the cephalohematoma should be suspected as the primary source of infection. If left untreated, an infected cephalo-

FIGURE 2 ■ Superficial cerebral veins.

The shearing of emissary and diploic veins during labor is responsible for the increased blood content of the cephalohematoma.



From: Netter, F. H. (2006). *Atlas of human anatomy* (4th ed., p. 102). Philadelphia: WB Saunders. Reprinted by permission.

hematoma can lead to meningitis, cellulitis, osteomyelitis, or death.[12,16,17] In a study of charts from 1978 to 2003 at Mackay Memorial Hospital in Taipei, Chang and colleagues found 28 cases of infected cephalohematoma.[16] According to this and other studies, incidence of infection was increased when a scalp electrode had been used, when needle aspiration had been attempted, and when systemic infection had already existed in the infant. The most common organisms cultured from the encapsulated fluid have been *Escherichia coli* and *Staphylococcus aureus,* although other organisms have been identified.[12,16,18]

Symptoms of an infected cephalohematoma include irritability, poor feeding, lethargy, enlargement or fluctuation of the cephalohematoma, localized erythema, visible abscess, fever (in only 60 percent of cases), an elevated C-reactive protein, leukocytosis, pustules, sensitivity to touch of the lesion, presence of a systemic infection (especially meningitis), relapse of a previous infection, and delay in the recovery of a current infection. It is difficult to discern whether the cephalohematoma is the primary site of an infection that leads to secondary systemic involvement or whether a systemic infection in progress secondarily infects the cephalohematoma.[12,16,18]

Needle aspiration of the fluid from within the cephalohematoma is used to diagnose infection. Needle aspiration is used only when infection of the lesion is suspected and all other possible sources of infection have been eliminated. It should not be used routinely to facilitate resolution of the cephalohematoma because the procedure could introduce organisms to a previously sterile area.[12] When an infection is suspected, a full sepsis workup is recommended, including a spinal tap and urinalysis.[16] A computed tomography scan (as opposed to a skull radiograph) could reveal evidence of osteomyelitis, epidural abscess, or subdural empyema.

Anemia. An infant with a cephalohematoma is at risk for anemia because blood has been diverted from circulation to the collection forming subperiostially. The amount of blood involved in this process varies from occurrence to occurrence. In general, the larger the lesion, the more blood is assumed to be involved. In rare cases, blood must be replaced through transfusion.[1]

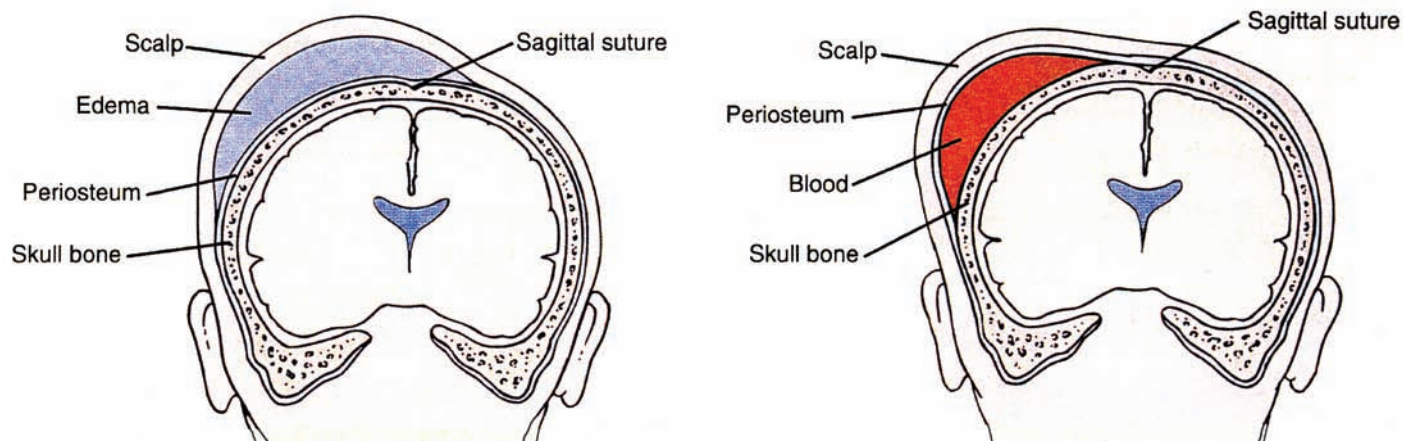
Hyperbilirubinemia. A common side effect of cephalohematoma is hyperbilirubinemia. It occurs when red blood cells in the cephalohematoma are destroyed, yielding the by-product of heme, which is metabolized to bilirubin, resulting in an increase in bilirubin levels.[19] Bilirubin levels should be monitored as the cephalohematoma resolves. Phototherapy is effective in returning unconjugated bilirubin levels to normal.[20]

DIFFERENTIAL DIAGNOSIS

Differential diagnosis involves distinguishing caput succedaneum from cephalohematoma.[1] Subgaleal hemorrhage should also be part of the differential diagnosis. Subgaleal hemorrhage may initially be mistaken for caput succedaneum because blood crosses cranial suture lines in both conditions, but subgaleal hemorrhage, in contrast to cephalohematoma, is potentially life threatening.[21] For a complete study of

FIGURE 3 ■ Two types of lesion.

This comparison summarizes the factors that set these two injuries apart.



Understanding the Differences

Caput Succedaneum

- Condition marked by localized soft tissue edema with poorly defined outline
- Caused by pressure of the fetal head against the cervix during labor, which decreases blood flow to the area and results in edema
- Present at birth; does not increase in size
- Swelling crosses suture lines
- Disappears after birth within a few hours to several days
- Complications are rare

Cephalhematoma

- Condition marked by soft, fluctuant, localized swelling with well-defined outline
- Caused by subperiosteal hemorrhage
- Appears after birth; increases in size for 2–3 days
- Swelling does not cross suture lines
- Disappears from several weeks to even months after birth
- Complications include defective blood clotting, underlying skull fracture or intracranial bleeding, and jaundice

From: Nichols, F. H., & Zwelling, E. (1997). *Maternal-newborn nursing theory and practice* (p. 1105). Philladelphia: WB Saunders. Reprinted by permission.

subgaleal hemorrhage, see "Neonatal Subgaleal Hemorrhage" in the July/August 2007 issue.

Differences among the conditions are summarized in Figure 3. Most notably, the cephalohematoma crosses the suture line only in the rare instance of craniosynostosis. The cephalohematoma is confined to one bone surface and is located more deeply at the subperiosteal level of the scalp than the other two conditions.[8] On prenatal ultrasound, the caput is difficult to distinguish from other soft tissue masses such as cephalohematoma, encephalocele, meningocele, and hemangioma. A transvaginal ultrasound is necessary, with final determination made at birth.[4] A caput should always be decreasing in size, whereas a cephalohematoma may grow for several days (see Figure 3).

TREATMENT OF UNCOMPLICATED LESIONS

Observation is the primary treatment for both the uncomplicated caput succedaneum and the cephalohematoma. Resolution of a caput is generally spontaneous and occurs within the first few days following birth.[6] A cephalohematoma may take longer to resolve, but most cases do so untreated within two to six weeks of life.[1] Antiobiotic ointment may be used to treat the occasional skin breakage from vacuum pop-offs.

TREATMENT FOR COMPLICATIONS OF CEPHALOHEMATOMA

Chang and colleagues suggest treating the neonate with an infected cephalohematoma in the absence of any other infection with intravenous antibiotics for one to two weeks. While awaiting culture results, the patient should receive antibiotic coverage for both *E. coli* and *S. aureus*. When a specific organism is identified, antibiotic treatment can be adjusted for sensitivity. If the clinical presentation of the patient does not improve with antibiotic treatment, several treatment options should be considered. Surgical incision, drainage, and evacuation of the cephalohematoma may be indicated. Antibiotic resistance may be occurring, or osteomyelitis, epidural abscess, or subdural empyema may be considered. Subdural empyema would require treatment with intravenous antibiotics for four to six weeks.[16]

Persistent disfiguring calcified cephalohematoma may require surgical augmentation of the bony prominence, as described by Chung and colleagues. The deformity is shaved off and a contouring surgical burr used to reshape the skull and restore correct anatomic form. The bony cap is removed from the cephalohematoma and the underlying material debrided. Bone shavings are used to fill in any depression left. Chung and coworkers describe their success with this

procedure in three patients (ages seven months to four years) with calcified cephalohematomas. All were satisfied with the results of the procedure, and no recurrences were noted.[13]

Peterson and associates have described passive cranial molding-helmet therapy as an effective nonsurgical treatment for calcified cephalohematoma with resultant cranial asymmetry. This treatment involves placing a molding helmet on the infant's head for 18–20 hours a day until the desired cranial shape is achieved. The treatment capitalizes on the malleability of the infant head up to 12 months of age and on the infant's growth factor. The success of the molding helmet has been limited to partially calcified cephalohematomas. A fully calcified lesion would not be expected to respond as well.[15]

CONCLUSION

Birth trauma to the scalp is often an unavoidable sequelae of the birthing process. Caput succedaneum and cephalohematoma, both commonly seen, are generally benign but should not be ignored. Caregivers who are aware of serious potential complications will heighten assessments when observing these injuries. Communication with nursery staff regarding instrument-assisted deliveries would alert all health care providers to watch closely for the potential symptoms of trauma. Charting the presence, size, and appearance of any scalp deviation is the first step in establishing the baseline documentation for successful observation of any birth injury to the head. Parents should be advised as part of their discharge instructions to report any changes in their infants' appearance or behavior between follow-up visits, with especially close observation of a scalp injury.

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