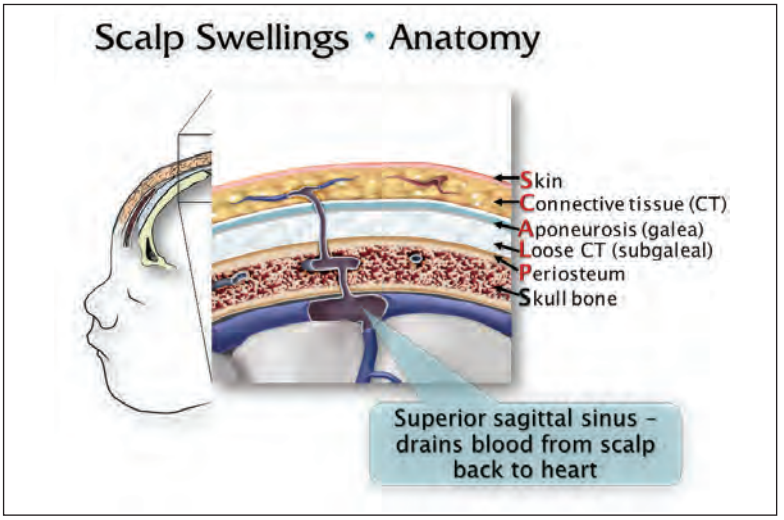
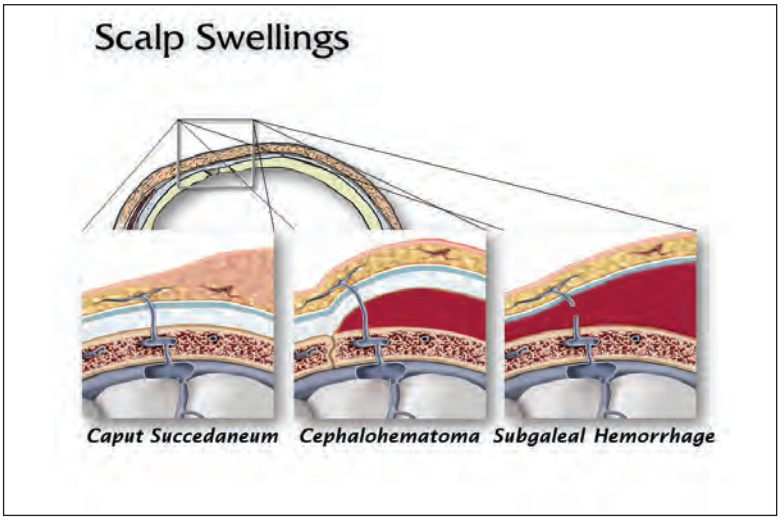
Appendix 4.1 Scalp Swellings: Caput Succedaneum, Cephalohematoma, Subgaleal Hemorrhage

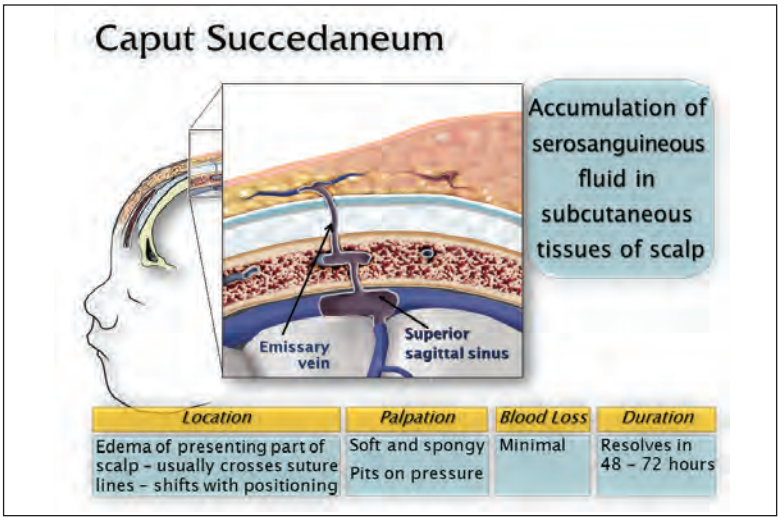
Scalp swelling is a common finding in newborn infants. It is important to know the features of three types of swelling: caput succedaneum, cephalohematoma, and subgaleal hemorrhage, so that appropriate observation and management may be provided. In addition, parents may be concerned about the appearance of their infant's scalp. Being knowledgeable about the various types of swelling will allow you to offer words of reassurance as well as education about how long it will take for the swelling to resolve.





Caput succedaneum

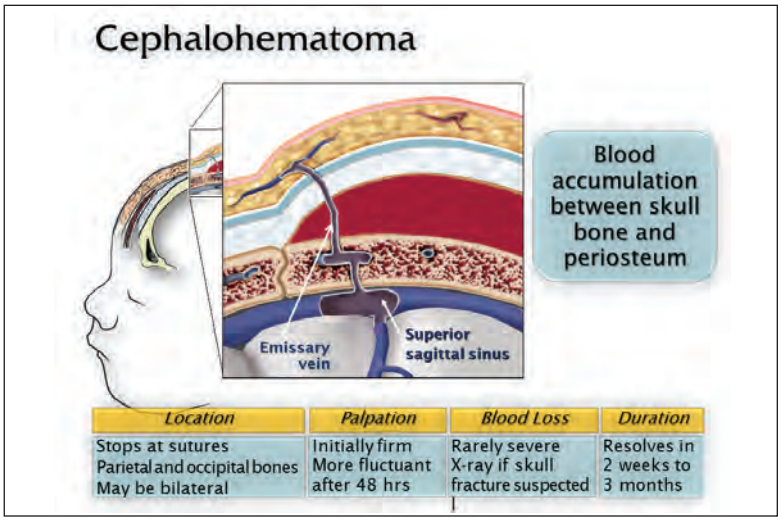
Following birth, molding of the head with concurrent swelling of the soft tissues of the scalp may be observed.[76] With caput succedaneum, swelling is superficial (extraperiosteal) and it recedes relatively quickly.[77] The swelling is composed of serosanguineous fluid that is usually limited to the region of the scalp that was the presenting part.[78] Because of its location, the edema may cross suture lines and it may be dependent. This means, as the infant's position changes, the swelling may shift. Bruising may be noted in the area of swelling and it is important to differentiate caput succedaneum from cephalohematoma, and from subgaleal hemorrhage, since all three may appear similarly at first. It is important to know however, that subgaleal hemorrhage, which is described further in this appendix, may extend rapidly, and lead to hypovolemic shock (hypotension, severe anemia, and altered level of consciousness). If subgaleal hemorrhage is not treated expeditiously, the risk of dying increases.[78]

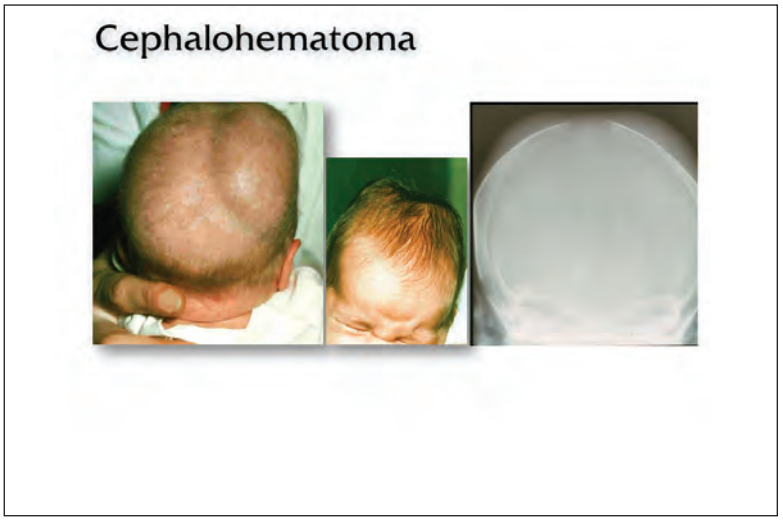


Appendix 4.1 Scalp Swellings: Caput Succedaneum, Cephalohematoma, Subgaleal Hemorrhage (continued)

Cephalohematoma

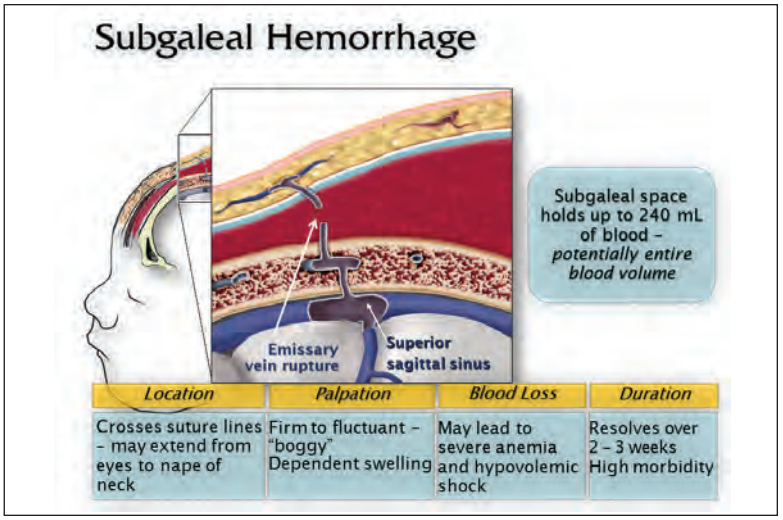
The periosteum is a membrane of fibrous connective tissue that wraps around bone. A hemorrhage that occurs under the periosteum of the skull (subperiosteal) is called a cephalohematoma.[77,79] The periosteum limits extension of the hemorrhage; therefore, the area of swelling will not cross suture lines. Often the hemorrhage feels firm and 85% of the time, the swelling is unilateral; 15% of the time bilateral cephalohematoma occurs. There is an occasional association of skull fracture, including depressed skull fracture, therefore additional testing such as a skull x-ray or CT scan may be indicated.[77] In rare cases, the bleeding can be severe enough to cause anemia. Usually a cephalohematoma will resolve within 2 to 12 weeks.[79]





Subgaleal hemorrhage

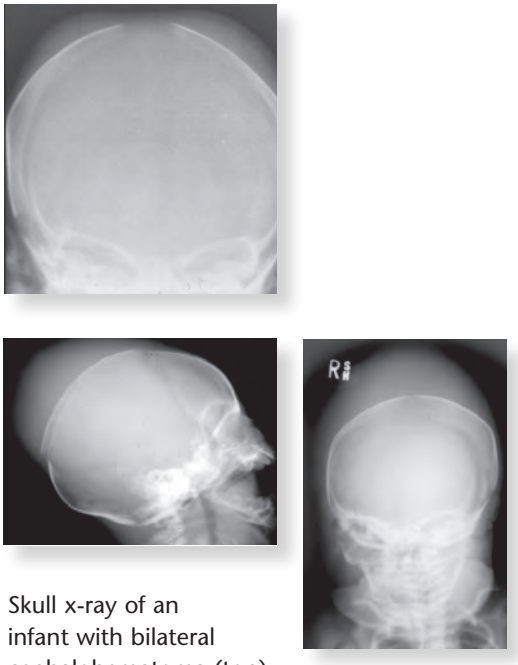
Venous return of blood from the scalp to the heart is via the scalp veins to the emissary veins to the dural sinuses, to the heart.[77] Rupture of the emissary veins can occur during a vacuum assist delivery secondary to the traction force applied, or as a consequence of pop-offs during vacuum assist delivery.[77] Subgaleal hemorrhage occurs when the emissary veins rupture and bleed into the subaponeurotic space which is located above the periosteum.[76,80,81] Unlike cephalohematoma, which has the periosteum to limit the spread of bleeding, there is no barrier to stop the bleeding, therefore, subgaleal hemorrhage can be massive.



Risk Factors for Subgaleal Hemorrhage

When a vaginal delivery is assisted by vacuum extraction or forceps, it is called an "operative vaginal delivery."[82,83] There are important specific indications for maternal and fetal candidacy for operative vaginal delivery, as well as guidelines for when it is safe to apply the vacuum or forceps, how to perform the procedure correctly, how many pop-offs should be permitted, how many minutes the procedure should be allowed to continue and importantly, when to abandon the attempt.[81] It should be noted that pop-offs are most often the result of an improperly placed cup and the more pop-offs there are, the risk for scalp injury is increased.[77,81,84] To prevent unplanned and unwanted injury to the mother and/or infant, it is important that obstetric caregivers observe standards of care regarding operative vaginal delivery.[84] When an operative vaginal delivery is performed, neonatal caregivers should be made aware so they may provide the appropriate assessment and monitoring for complications.[77] Especially if the procedure met with difficulty, the neonatal caregivers should be notified so that an appropriate monitoring guideline may be activated.[85]

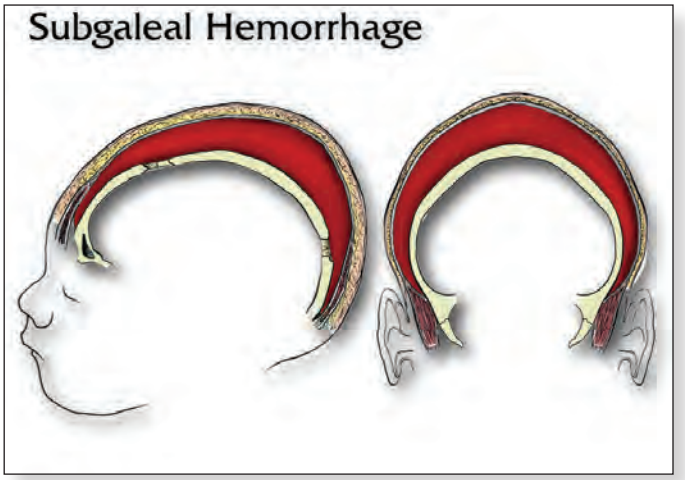
Because there is no requirement for mandatory medical error reporting in the United States, the incidence of subgaleal hemorrhage is likely under-reported and under-appreciated. One estimate by the American College of Obstetricians and Gynecologists is that subgaleal hemorrhage occurs in 26 to 45 of every 1000 vacuum-assisted deliveries.[86] Another large study by Towner[87] reported subgaleal hemorrhage occurred in 1 in 860 vacuum-assisted deliveries compared with 1 in 1900 spontaneous vaginal deliveries. However, when vacuum and forceps were both used, the incidence was markedly increased; 1 in 280 deliveries.[87] Therefore, inspection of the scalp after a vacuum-assist delivery should include evidence of any apparent injury, lacerations, location and degree of swelling, bruising, and where the vacuum marks are located. An improperly applied cup increases the risk for scalp injury and/or subgaleal hemorrhage.[81,84,88,89] Following operative vaginal delivery, blood may also accumulate in other regions in the brain: subdural, subarachnoid, intraparenchymal, and intraventricular spaces.[77]



Skull x-ray of an infant with bilateral cephalohematoma (top) and subgaleal hemorrhage (bottom two x-rays). Notice the blood is limited to the subperiosteal space with cephalohematoma, but diffusely located in the scalp with subgaleal hemorrhage

Appendix 4.1 Scalp Swellings: Caput Succedaneum, Cephalohematoma, Subgaleal Hemorrhage (continued)

The subgaleal space is estimated to hold as much as 240 to 260 mL of blood. That amount of blood would be the entire blood volume of a 3 kilogram infant.[76,79] The scalp aponeurosis extends all the way from the orbits of the eyes to the nape of the neck. One characteristic finding of subgaleal hemorrhage is the lateral spreading of edema toward the ears, which may displace the ears anteriorly (shown in photo). Swelling around the eyes is also present in some cases.[78] A fluid wave may also be observed when pressing on the edematous scalp. Knowing this anatomy is helpful because inspection of the scalp that reveals swelling in these regions is significant.[79] Treatment of subgaleal hemorrhage may include any or all of the following to treat anemia, stop the bleeding and restore the blood pressure: PRBCs, fresh frozen plasma, platelets, cryoprecipitate, normal saline volume infusions, and dopamine.[78]



Risk factors associated with development of SGH after vacuum-assisted delivery (VAD)[81,88,90-92] includes:

- Nulliparous mother
- Failed vacuum extraction
- Inadvertent cup release (pop-offs)
- Sequential use of vacuum and forceps
- Apgar score less than 8 at five minutes following vacuum assist delivery
- Deflexing cup application (edge of the cup application less than 3 cm from the anterior fontanel)
- Paramedian cup application (cup centered more than one centimeter lateral to the sagittal suture)

Infant with severe subgaleal hemorrhage. The infant required numerous blood product transfusions to stabilize. The infant's outcome is unknown.