

PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on “Neonatal Extracranial Head Injuries.” These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedscases.com/podcasts.

Neonatal Extracranial Head Injuries

Developed Nadia Moledina and Dr. Chloe Joynt for PedsCases.com.
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Hi, my name is Nadia Moledina and I am currently a medical student at the University of Alberta. This podcast was developed in conjunction with Dr. Chloe Joynt, a neonatologist at the Stollery Children’s Hospital in Edmonton, Alberta.

This podcast will discuss neonate head injuries during the birthing process. Major outcomes we hope to address throughout this podcast include:

- Outline the major risk factors associated with birth injuries
- Classify the varying types and presentations of head injuries commonly seen during labour and delivery
- Give an overview of the management, prognosis and complications associated with these head injuries

It is important to get a basic understanding of the anatomy of the scalp in order to visualize where different injuries can take place.

In a very simplified form, the most superficial layer of the scalp is the skin with a layer of underlying connective tissue. Below this is the galea aponeurosis with another underlying layer of loose connective tissue. There is a potential space between the scalp and the galea for fluid to collect. Next is the periosteum, which covers the outer surface of the cranial bones. There is another potential space located between the galea and the periosteum. Beneath the periosteum are the cranial bones, which will contain the brain and other important structures. Between the cranial bones and the periosteum is another potential space for fluid buildup. Any kind of injury therefore occurring deep to the cranial bones is considered intracranial whereas those injuries that are superficial to the cranial bones are extracranial. Please note that in this podcast we will focus on extracranial head injuries. Further, we will be primarily focused on mechanical injuries as opposed to those caused by hypoxia.

Let’s begin with the potential risk factors that may predispose a baby to a head injury during the process of labour and delivery.

Many of these injuries are due to the relationship between the birth canal and the baby’s

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head. Greater disproportion creates more stress placed on the baby's head during delivery making it more prone to being injured. Contributing factors to this include if the mom is primiparous, at an increased maternal age or if she anatomically has a cephalopelvic disproportion which often means the mom's pelvic opening is too small for the baby's large head. During the delivery process, the baby also undergoes some very characteristic cardinal movements, which assist its exit out of the birth canal. If there is failure of adequate birth canal adaption as is seen in the breech position or if there are abnormal presentations such as face, brow or transverse, the baby may have a difficult time being delivered and may incur a head injury as a result. Often times if labour is not progressing or the baby is exhibiting signs of distress, an instrumental vaginal delivery may be conducted with the assistance of a vacuum or forceps. This type of delivery puts the baby at a higher risk of a head injury as the instruments are often applied to the head to assist in delivery. Additionally, babies with known clotting disorders or those who are prematurely delivered can also have increased risk of head injury during delivery.

Now that we have an understanding of the risk factors that can predispose a baby to a head injury during birth, lets begin to classify the different types of head trauma. I will initially talk about their presentations and then I will go into the associated management and complications.

First I will discuss a caput succedaneum. A caput is characterized by localized scalp edema above the pericranium and between the outer most layer of the scalp and the subcutaneous tissue. It is important to note that since this edema is quite superficial and above the periosteum, caputs have the ability to cross the bony suture lines. They are often seen on the presenting portion of the baby's skull during vaginal delivery. They are usually caused from venous compression associated with increasing pressure on the head from the dilated cervix as is seen with prolonged labour. The caput is soft to touch with irregular margins and the fluid collection is greatest immediately at delivery and will gradually decrease in size thereafter. The depth of the caput is generally 1-2 cm however the circumference can be variant with the serous fluid having the ability to shift side to side as the infant changes their head position. The caput may also be associated with overlying petechiae, purpura or ecchymoses. A chignon is a term for an artificial caput and is often produced as a result of a vacuum assisted delivery where a vacuum caput is produced at the site of instrument contact with the head.

The second type of injury I will discuss is a cephalohematoma. Cephalohematomas are characterized by localized, subperiosteal collection of blood contained within suture lines. Therefore, the bleeding is in the potential space between the periosteum and the bone. Cephalohematomas are caused by the rupturing of blood vessels due to friction that separates the periosteum from the skull during birth. There is a highly increased occurrence in the presence of instrumented vaginal deliveries. The cephalohematoma will present as a firm, tender, mass that usually first appears hours or even days after delivery and can increase in size thereafter for 2-3 days. Even as it gets bigger it should not cross the suture lines. The reason for this delayed onset is due to the slow nature of the subperiosteal bleeding. Cephalohematomas are more commonly present in males, they favour the parietal bones, and are more likely to present unilaterally.

The third type of injury I will discuss is a subgaleal hemorrhage. This injury takes place in the subaponeurotic space between the galea aponeurotica and the periosteum. Therefore there is fluid collection in the potential space between the galea and the periosteum. Hemorrhage is caused by damage to the emissary veins that are in between the scalp and the intracranial venous sinuses due to increased traction on the scalp. Vacuum procedures are one of the biggest risk factors associated with this form of traumatic head injury. A subgaleal hemorrhage often presents as “boggy fluid collections with a ballotable fluid wave beneath the scalp and bleeding extending to above the eyes and back to the insertion of the trapezius muscle”. This fluid collection will usually increase in size after birth. The occipital frontal circumference has the potential to increase by 1cm with every 40mL deposition of blood in the subaponeurotic space. This space can accommodate as much as 250ml. To put this into perspective, babies usually have a total blood volume that is close to 80mL per kg with a typical baby weighing 3.5kg. As a result, this can be a potential for a neonatal emergency. If there is a large volume of blood loss in this space, infants will present early with pallor, tachypnea, and tachycardia. As the volume in the space grows, they can present with mottling, hypertension and lethargy. Obviously a drop in their hematocrit is also associated. Large subgaleal hemorrhages can present with pitting edema as well as spread posteriorly toward the neck and laterally to the ears. The ears can sometimes appear as being pushed forward. It should be understood that occasionally subgaleal hemorrhages can also present in a silent manner where there won't be a large mass present. Therefore, it's important that subgaleal hemorrhages still be considered in those newborns that have had an attempted or successful vacuum delivery and show signs of hyperperfusion or decreased hematocrit.

In doing a quick recap, there are a few key features that will help differentiate between the varying types of head injuries we have discussed so far. A cephalohematoma can often be mistaken for a caput, especially when the cephalohematoma occurs bilaterally. Cephalohematomas can be differentiated from caputs through key factors such as their distinct limitation to one bone as they are constrained by suture lines. Additionally, their timing of onset and resolution of swelling can provide another clue. Subgaleal hemorrhages can often be differentiated from cephalohematomas by their boggy and fluid wave, their widespread distribution that isn't constricted by suture lines and their ability to grow rapidly. Additionally, cephalohematomas are often associated with anemia and have an increased likelihood to present with signs of decompensation.

We hope you now have a good understanding of the common extra cranial injuries that can present during the birthing process. Now let's move onto how these head injuries can be managed and what the prognosis and potential complications for each are.

Caput succedaneums are usually the most easily managed head injuries and they will often resolve naturally after the first few post natal days. The prognosis for a normal recovery is very good however sometimes babies may develop a halo scalp ring, which is hair loss in the area of the caput as a result of some tissue necrosis related to the increased pressures. The hair will usually grow back with time but rarely there can be permanent scarring and hair loss.

A cephalohematoma may take longer to resolve, but most cases do so untreated within two to six weeks of life. Possible complications include skull fracture, calcification, and infection. Calcification of a cephalohematoma is often considered if it persists beyond 4 weeks and presents with a bony swelling. The bony swelling rarely may persist for several months. Cephalohematomas can be associated with localized infection and should be thought of in a newborn that presents with signs of unexplained sepsis. Treatment of an infected cephalohematoma should involve IV antibiotics with *E. coli* and *S. aureus* coverage until culture results have come back. Surgical incision, drainage and evacuation of the cephalohematoma may rarely be indicated if the condition does not improve. Due to the collection of blood and its eventual breakdown, newborns are also at a higher risk for hyperbilirubinemia and may require photo treatment. Untreated infected cephalohematomas have the risk of progressing to osteomyelitis or meningitis.

Vigilant observation and management of a subgaleal hemorrhage can prevent devastating consequences. The acute blood loss and hypovolemia associated with a subgaleal hemorrhage presents a life-threatening emergency that needs immediate observation and management in a NICU. Subgaleal hemorrhages can cause a loss in 20-40% of the circulating blood volume and may create a state of hypovolemic shock, disseminated intravascular coagulation (DIC), and multiorgan failure which can lead to death in up to 25% of cases. With very large lesions, there is also the potential to cause extracranial cerebral compression, which can rapidly cause neurologic decompensation. The most indicative risk factors for neonate mortality are significant birth asphyxia and a decrease in hematocrit that is greater than 25% of the baseline value at birth. Steps for management of a symptomatic subgaleal hemorrhage follow the simple rule of common sense.

- 1) Start with assessing the ABC's and ensure the baby is transported to the NICU and has monitors placed on.
- 2) Establish reliable intravenous access which can include an umbilical line.
- 3) If time permits, placement of an umbilical arterial line can be used for blood draws and blood pressure monitoring however a simple BP cuff can also be used.
- 4) Vigilant replacement of volume losses in 10- to 20-mL/kg infusions. This can be whole blood or normal saline if the situation is emergent or cross-matched packed red blood cells if time permits. Replacement of coagulation factors and platelets should also be carried out as required. Anticipate a 40-mL blood loss for each 1-cm increase in occipital frontal circumference.
- 5) Careful attention to oxygenation with supplemental oxygen and mechanical ventilation if required.
- 6) Monitoring of serial hematocrits and coagulation studies to assess progress and the potential for disseminated intravascular coagulation.
- 7) Accurate monitoring of the volume infused, BP, metabolic status and urine output
- 8) Attention to other organ systems that may have been affected by the hypovolemic shock.
- 9) If the baby continues to deteriorate with signs of decompensation, a neurovascular consult should be attained. Very rarely do surgical interventions need to be completed because a subgaleal hemorrhage is a self-limited process

that often tamponades on itself.

- 10) When the baby is stabilized an elective MRI should be considered. The outcomes of a subgaleal hemorrhage are therefore very dependent on the presenting signs and symptoms and how quickly the baby is able to respond to aggressive intervention.

In summary, both caputs and cephalohematomas usually resolve on their own with caputs often taking a shorter amount of time. Subgaleal hemorrhages should be monitored based on presenting symptoms, as they can be a life threatening condition. However, with appropriate management these will also eventually resolve.

This brings us nearing the conclusion of this podcast. In order to allow for a better understanding of some common extracranial head injuries associated with birth, we hope to have addressed a few key objectives. Questions we hope you feel more comfortable answering after this podcast are as follows:

- What are the major risk factors related to head injuries during birth?
- How can you differentiate between the major types and presentations of extracranial head injuries incurred during birth?
- What is the prognosis and appropriate management for these types of head injuries, and what kind of complications can arise throughout their course?

Thank you for listening!

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