

PedsCases Podcast Scripts

This podcast can be accessed at www.pedscases.com, Apple Podcasts, Spotify, or your favourite podcasting app.

The evaluation and management of neonatal brachial plexus palsy – CPS podcast

Developed by Morgan Gregg and Dr. Vibhuti Shah for PedsCases.com.
March 8, 2022.

Introduction:

Hi everyone! My name is Morgan Gregg, and I am a third-year medical student at the University of Alberta. In this podcast, we will explore the risk factors, classification, clinical presentation, and management of neonatal brachial plexus palsy using the information provided in the Canadian Pediatric Society Position Statement titled "The evaluation and management of neonatal brachial plexus palsy".

This podcast was developed in collaboration with Dr. Vibhuti Shah, neonatologist and member of the Department of Pediatrics, Mount Sinai Hospital, and the first author on this statement.

For more information and to see the full CPS position statement please visit www.cps.ca.

Learning objectives

After listening to this podcast, the learner should be able to:

1. Define neonatal brachial plexus palsy and describe the key risk factors for developing this palsy.
2. Outline the classification and clinical presentation of brachial plexus palsy.
3. Describe the prognosis and outcomes of brachial plexus palsy.
4. Develop an approach to management and follow-up, including when to refer to a multidisciplinary specialized team.

Case

Let's start with a case. Avery was born 1 hour ago to a mom with pre-existing diabetes. She was 4.7 kg at birth and was born following a difficult delivery complicated by shoulder dystocia. When you enter the room, you notice that Avery's right arm seems to move much less than her left. You remember that neonatal brachial plexus palsy can present with asymmetrical arm movements. Before you make a diagnosis, you want to fully evaluate the risk factors and physical features present in Avery's case.

Let's dive into neonatal brachial plexus palsy so we can learn how to diagnose, evaluate, and manage this condition.

Definition

Neonatal brachial plexus palsy is defined as weakness or flaccid paralysis of the upper extremity caused by injury to one or more of the cervical and thoracic nerve roots from C5 to T1.

Epidemiology

Worldwide, the incidence of neonatal brachial plexus palsy ranges from 0.38 to 5.1/1000 live births with regional variations based on study setting, population-based data, and the availability of maternal-fetal care. In Canada, the incidence is reported to be 1.24/1000 live births based on the data from the Canadian Institute for Health Information.

Mechanism and Risk factors

Historically, neonatal brachial plexus palsy was believed to be a result of excessive downward traction after delivery of the fetal head in births with shoulder dystocia. But, while shoulder dystocia remains the strongest modifiable risk factor, it can still occur in the absence of shoulder dystocia.

Factors that have been strongly associated with brachial plexus palsy include humeral fracture, shoulder dystocia, and clavicular fractures. A moderate association has been noted with pre-existing maternal diabetes, forceps or vacuum-assisted delivery, episiotomy, fetal or birth asphyxia, macrosomia, and large for gestational age infants.

Caesarean section and twin or multiple births are associated with reduced risk of brachial plexus palsy.

Classification and Clinical Presentation

The clinical presentation of brachial plexus palsy can range from transient weakness to global paresis, depending on the severity of injury. The Narakas classification system is used to group severity of injury from I to IV.

- **Group I**, or the Classic Erb's palsy, occurs due to injury of C5 or C6 roots. Weakness or paralysis occurs in shoulder abduction and external rotation, elbow flexion, and forearm supination. Clinically, the arm will appear straight and turned inward.
- **Group II**, or extended Erb's palsy, occurs as a result of injury of C5 to C7 roots. The pattern of weakness is similar to the classic Erb's palsy, with the addition of absent wrist and digital extension. Clinical appearance is also similar to the Classic Erb's palsy, but with the wrist and fingers flexed.
- **Group III** occurs from injury to the C5-T1 roots, or the complete brachial plexus, which causes total palsy without Horner's syndrome. Clinical presentation includes complete flaccid paralysis of the arm, also known as flail extremity, due to involvement all plexus roots.

- Finally, **Group IV** results from an avulsion injury to the C5-T1 roots as well as the sympathetic chain. This results in complete flaccid paralysis and Horner's syndrome, which presents with ptosis, miosis and ipsilateral facial anhidrosis. It can be associated with phrenic nerve palsy and an elevated ipsilateral hemi-diaphragm.

Diagnosis

In situations such as Avery's, the physician must take a detailed history and perform a focused physical exam on any neonate showing the symptoms and signs of brachial plexus palsy as described above.

History

A detailed maternal history including delivery details must be obtained in order to identify risk factors for brachial plexus palsy and the specific etiology of the injury.

Physical exam

Neonatal care providers should evaluate all newborns for brachial plexus palsy when delivery has been complicated by shoulder dystocia, or if asymmetrical upper extremity movement is apparent, as was seen in Avery. A musculoskeletal and neurological exam including active and passive range of motion and normal reflexes must be done. The physician should also assess for clavicular or humeral fracture, which can mimic brachial plexus palsy due to pain limiting the infant's range of motion. Finally, one must assess the newborn's respiratory status and check the symmetry of their chest movements to rule out phrenic nerve injury.

Investigations

If there is concern of bony injury, chest and humeral x-rays should be performed. Furthermore, a chest x-ray or ultrasound must be performed if there is concern for phrenic nerve injury. An elevated hemi-diaphragm would be seen in phrenic nerve injury, which would suggest an avulsion injury in the plexus.

Differential diagnosis

The differential diagnosis that should be considered includes myotonia congenita; anterior horn cell injury; pyramidal tract or cerebellar lesions; or pseudoparesis, which is limited motion due to pain secondary to humeral fracture or infection to bone, joints, soft tissue, or vertebrae.

Treatment and follow-up

We will now discuss the current evidence for management of brachial plexus palsy. Firstly, groups I and II are associated with higher rates of spontaneous recovery and

often no treatment is necessary. Neonates who fully recover by 1 month are managed conservatively. Infants with group III and IV injury who show no signs of recovery should receive reconstructive microsurgery to repair the injured plexus.

A gray zone exists between these two extremes however. One study showed that 81% of infants fell into this gray zone where optimal therapy is unclear. Because of this gray zone, infants with no active elbow extension at 1 month should be referred to a specialized center, as by that time the likelihood of spontaneous recovery is low.

Prognosis and complications

Now let's talk about the prognosis of brachial plexus palsy and possible complications. Recovery in infants with Erb's palsy ranges from 69% to 95%, while only 20% of those with total C5-T1 injuries recover fully by 18 months. Furthermore, although there are surgical options for those with severe palsy, research shows that 20 to 30% of infants never fully recover. The long-term consequences of persistent brachial plexus palsy include weakness, development of skeletal malformations such as contractures and limb length discrepancy, as well as cosmetic deformities.

When to refer

All neonates with incomplete recovery by 1 month should be referred immediately to a multidisciplinary health care team which includes a physiotherapist, occupational therapist, and plastic surgeon. Incomplete recovery is defined by absent active elbow extension and flexion at 1 month of age, which implies nerve injury beyond neuropraxia and is associated with a poor prognosis. Please see Table 1 (final page of this script) for a guideline on the information to include when referring a patient for brachial plexus palsy. In brief, patient demographics, information related to the delivery, risk factors, severity, and course of recovery should be included in the referral. For infants receiving non-operative therapy in their community, continuous dialogue among the child's multidisciplinary health care team, community health care providers, and non-operative therapists is required to identify issues of growth and development and facilitate specialized assessments as needed.

Case Conclusion

Now let's go back to our case.

As you would have noted, Avery had many risk factors for developing neonatal brachial plexus palsy including maternal diabetes, shoulder dystocia during delivery, and macrosomia.

Knowing this, you get a thorough maternal and delivery history and you do not identify any additional risk factors.

Next, you perform a complete physical exam with a focused musculoskeletal, neurological, and respiratory exam. On exam, you note weakness in shoulder abduction and external rotation, elbow flexion, and forearm supination, as well as wrist and digital extension, and symmetrical chest expansion. To mom's relief, Avery does not have any fractures and does not have Horner's syndrome. You correctly identify this as Group II on the Narakas classification scale, or extended Erb's palsy. You reassure Avery's mom that Group II is associated with a high rate of spontaneous recovery, and that it will be managed conservatively until 1 month of age.

At 1 month old, Avery presents to the clinic you are currently doing a rotation on for a follow-up appointment. On examination it is noted that she has incomplete recovery and hence a referral to the multidisciplinary specialist team is made for further evaluation and management.

Summary

Okay, now let's review some of the key concepts regarding neonatal brachial plexus palsy.

1. The definition of neonatal brachial plexus palsy is weakness or flaccid paralysis of the upper extremity diagnosed soon after birth that is caused by injury to one or more of the cervical and thoracic nerve roots making up the brachial plexus.
2. It is most commonly caused by stretching of the nerves during delivery, but can also be from compression, inflammatory or infectious infiltration, or hypoxic injury to the plexus.
3. The clinical presentation varies depending on which nerves are involved but can range from transient weakness to global paresis. The Narakas classification system is used to group severity of injury on a scale of I to IV.
4. Treatment is often unnecessary if the infant has a neuropraxic injury, but those with incomplete recovery at one month should receive a referral for to a specialized care team and potentially reconstructive microsurgery.

That concludes this podcast on neonatal brachial plexus injuries. Thank you for listening!

References

Shah V, Coroneos CJ, Ng E. The evaluation and management of neonatal brachial plexus palsy. *Paediatr Child Health*. 2021;26(8):493-497. Published 2021 Dec 27. doi:10.1093/pch/pxab083

| | |
|---|---|
| PATIENT INFORMATION Name: Address: Postal Code: Tel#: Health Card #: | REFERRING PHYSICIAN INFORMATION Name: Address: Postal Code: Tel#: Fax#: Email: |
| PATIENT DEMOGRAPHICS Date of referral: _____ Sex: Male <input type="checkbox"/> Female <input type="checkbox"/> Date of birth: _____ | |
| DELIVERY Birth weight: _____ Delivery: Cephalic <input type="checkbox"/> Breech <input type="checkbox"/> Caesarean <input type="checkbox"/> Traction: Forceps <input type="checkbox"/> Vacuum <input type="checkbox"/> Episiotomy <input type="checkbox"/> | STRONG RISK FACTORS Shoulder dystocia: Present <input type="checkbox"/> Absent <input type="checkbox"/> Clavicle fracture: Present <input type="checkbox"/> Absent: <input type="checkbox"/> Humeral fracture: Present <input type="checkbox"/> Absent: <input type="checkbox"/> |
| CLINICAL Side with deficit: Right <input type="checkbox"/> Left <input type="checkbox"/> Complete paralysis: Present <input type="checkbox"/> Absent: <input type="checkbox"/> <i>(No active movement of shoulder, elbow, wrist, or fingers)</i> Horner’s syndrome: Present <input type="checkbox"/> Absent: <input type="checkbox"/> <i>(Constricted pupil, weak and droopy eyelid)</i> | ACTIVE MOVEMENT Shoulder: Present <input type="checkbox"/> Absent: <input type="checkbox"/> <i>(Active elevation against gravity, can raise arm above head)</i> Elbow: Present <input type="checkbox"/> Absent: <input type="checkbox"/> <i>(Active flexion against gravity, can bring hand to mouth)</i> Wrist: Present <input type="checkbox"/> Absent: <input type="checkbox"/> <i>(Active wrist extension, can bend “wrist back” with grasp)</i> Fingers: Present <input type="checkbox"/> Absent: <input type="checkbox"/> <i>(Active fingers flexion, can “grasp”, make fist, close fingers)</i> |

Table 1. Information to be included in the referral form for brachial plexus palsy