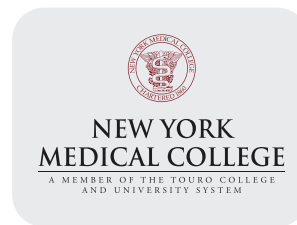


# The Perinatal Gazette

Newsletter of the Regional Perinatal Center Maria Fareri Children's Hospital at Westchester Medical Center



Volume 21, Issue 1

September 2021

## Neonatal Brachial Plexus Palsy (NBPP)

**Birth-related brachial plexus injury may be detected by neonatology and obstetrics providers immediately after birth. In this article, the diagnosis, initial workup, and subsequent management of neonatal brachial plexus palsy (NBPP) is reviewed.**

### Epidemiology

Injury to the brachial plexus, the network of nerves that supplies sensorimotor function to the upper extremity, is the most common nerve injury in children with an incidence of approximately 1.5 per 1,000 live births. Shoulder dystocia and macrosomia, or a birth weight over 4.5 kg, are the strongest risks factors, although additional perinatal risk factors exist, such as multiparous pregnancies, previous pregnancies complicated by a birth palsy, prolonged labor, and vacuum or forceps assisted deliveries. The mechanism likely involves distraction between the shoulder and head thereby placing traction on the nerves. However, our understanding is incomplete, as reflected by stable rates of NBPP despite changes in rates of shoulder dystocia and Cesarean section. Nonetheless, if left untreated, approximately 30% of patients will experience significant impairment in upper extremity function and quality of life.

### Clinical Presentation and Evaluation

Observation of spontaneous movement, stimulated motor activity, and neonatal reflexes is critical to detect NBPP and determine extent of injury. In the classic Erb's palsy, involving injury to the upper spinal nerve roots (C5, C6, and/or C7) of the brachial plexus, the upper extremity takes on a "waiter's tip" posture (Figure 1). The lack of shoulder abduction and external rotation (C5 injury), elbow flexion (C6 injury) and wrist supination and extension (C7 injury) results in an upper extremity that is adducted and internally rotated at the shoulder, extended at the elbow, and flexed at the wrist. Klumpke's palsy (C8-T1 injury) is rare in NBPP. A pan-plexus injury may occur in which all spinal nerves of the brachial plexus (C5-T1) are injured resulting in a "flail" extremity with no movement, including lack of hand movement.

Additional exam findings may provide hints as to whether the injury is proximal or very close to nerve roots exiting the spinal cord (pre-ganglionic injury) or more distal (post-ganglionic injury), which has significant implications for surgical treatment approach. Horner's syndrome, consisting of a drooping eyelid (ptosis), decreased pupil size (miosis), and lack of face sweating (anhidrosis), and phrenic nerve palsy, manifested by an elevated hemidiaphragm on chest x-ray, strongly suggest a pre-ganglionic injury, as the sympathetic chain and phrenic nerve are in close anatomic proximity to the spinal nerves. Pre-ganglionic injuries may be detected on magnetic resonance

imaging (MRI) of the brachial plexus as avulsed nerve roots with or without an associated cerebrospinal fluid collection (pseudomeningocele). MRI of the brachial plexus has taken the place of CT myelogram in most practices due to its non-invasive nature. Electrodiagnostic study in infants is technically challenging and controversial in that it may underestimate the severity of injury when compared to intraoperative findings. Plain x-rays are useful to assess for other causes of extremity weakness such as clavicle or humerus fracture. As fractures heal readily in infants, persistent weakness after 3 weeks is concerning for a concurrent NBPP.

### Surgical Indications

Approximately 70% of patients with NBPP will recover; therefore, identifying those patients for which innate recovery is unlikely is key for surgical evaluation. Pre-ganglionic injuries, such as those which nerve rootlets are avulsed from the spinal cord, will not spontaneously recover, as the spinal cord cannot regenerate. In such cases, brachial plexus reconstruction surgery may be offered as early as 1 to 3 months. However, post-ganglionic or more distal injuries may or may not recover based on the extent to injury. Serial physical exams are therefore performed to assess for return of strength over time. In general, failure of return of upper trunk function, as judged by non-antigravity biceps function by 3 to 6 months is commonly used as an indication for surgical intervention, as the natural history is unlikely to lead to further increase in functional strength. Multiple clinical systems for evaluation exist, and a Toronto score of less than 3.5 is another surgical indication. For pre-ganglionic injury, surgery is typically performed between 3 and 9 months, which reflects a balance in allowing for time to assess recovery but not too much time such that deinnervated muscles are less likely to accept regenerating nerves. Surgical referral is recommended early in the injury by 1 month to establish a baseline exam and develop a relationship with the parents. Serial exams on a 1-3 month basis are then performed. At the time of hospital discharge, early physical therapy is critical to maintain a full arc of joint motion and avoid muscle imbalances that can lead to contractures.

*Continued on page 2...*

## IN THIS ISSUE

|                                                                                                            |       |
|------------------------------------------------------------------------------------------------------------|-------|
| <b>Neonatal Brachial Plexus Palsy (NBPP)</b> . . . . .                                                     | Pg. 1 |
| <b>Indomethacin Prophylaxis for Closure of the PDA</b> . . . . .                                           | Pg. 2 |
| <b>Importance of Addressing Perinatal Mood and Anxiety Disorder to Reduce Maternal Mortality</b> . . . . . | Pg. 3 |
| <b>Congratulations Dr. Shetal Shah</b> . . . . .                                                           | Pg. 4 |
| <b>Welcome Dr. Meenakshi Singh, MBBS, FAAP</b> . . . . .                                                   | Pg. 4 |
| <b>Welcome Jeanette Diaz, BSN, RNC</b> . . . . .                                                           | Pg. 4 |
| <b>Welcome Rachel Feurstein, MPH</b> . . . . .                                                             | Pg. 4 |

## Neonatal Brachial Plexus Palsy (NBBP) *Continued from page 1*

### Surgical Management

Brachial plexus repair may be accomplished in one of two broad approaches. First, the brachial plexus may be explored for a neuroma, or site of nerve injury and scarring through which re-growing nerves cannot pass. Using microsurgical techniques, the neuroma is excised and replaced by a segment of normal nerve, a technique referred to as nerve grafting, such that growing nerves now have an unobstructed path to follow for regrowth. A small sensory nerve in the lower extremity, the sural nerve, is commonly used as a donor. For cases in which the neuroma is too extensive or the injury involves nerves as they exit the spinal cord, as in a pre-ganglionic injury, nerve grafting is not feasible. Instead, a part of a working nerve can be isolated and sewn into a non-working nerve to power it. This approach is referred to as a nerve transfer. For example, a common nerve transfer involves isolating a normal fascicle, or branch, of the ulnar nerve and re-routing it into the biceps branch of the musculocutaneous nerve to restore elbow flexion. In cases of a pan-plexus injury, donor nerves for transfer are taken outside of the brachial plexus, such as the spinal accessory nerve or intercostal nerves. In some cases, a combination of nerve grafting and transfers is performed. Nerve reconstruction surgeries are performed under general anesthesia without neuromuscular blockade. Brachial plexus exploration commonly involves an incision one fingerbreadth above clavicle in the posterior triangle of the neck. Nerve transfers may involve incisions in the upper extremity, chest, or back. Nerves are connected, or coapted, under microscopic assistance using one to two 8-0 sutures and covered with fibrin glue. A key principle is ensuring that the nerves are joined together without any tension.

### Post-Operative Management

Patients remain in the hospital overnight for observation and pain control and may be discharged to home the following day. To protect the delicate coaptation suture site, the upper extremity is immobilized in an infantile sling and swathe or a cast for four weeks, after which the patient begins unrestricted physical therapy. Patients are counseled that regenerating nerves grow slowly at a rate of approximately 1 mm per day or roughly 1 inch per month. Thus, 3 to 6 months are commonly required for regenerating nerve to pass from the site of injury to the muscle before clinical return of function is observed. Serious complications such as infection, respiratory distress, pneumothorax, chylothorax, permanent elevated hemidiaphragm, and vascular bleeding are rare. The most significant complication is failure of the procedure to restore useful active function. Secondary strategies such as muscle transfer, shoulder fusion, and free muscle transfer, although less commonly performed in children, may be offered if nerve surgery does not yield restoration of function.

*References available upon request.*



*Jared Pisapia M.D., M.T.R. is an attending pediatric neurosurgeon at Maria Fareri Children's Hospital and an Assistant Professor of Neurosurgery at NYMC. He underwent dual fellowship training in pediatric neurosurgery at the Children's Hospital of Philadelphia as well as peripheral nerve surgery at the University of Pennsylvania and Shriners Hospitals for Children in Philadelphia. In addition to pediatric brachial plexus injury, he treats the spectrum of pediatric neurosurgical conditions with a special focus on brain and spine tumors, hydrocephalus, and congenital and traumatic spine anomalies. He takes all insurances and sees patients in three NY locations in Valhalla, Suffern, and Poughkeepsie. For an appointment or referral, please call 914-775-5437.*

## Indomethacin Prophylaxis for Closure of the PDA

**The ductus arteriosus is a fetal vascular connection between the main pulmonary artery and the aorta, required to bypass pulmonary circulation. In utero patency of the ductus is maintained by low oxygen tension, high levels of prostaglandins-mainly PGE<sub>2</sub>, nitric oxide and carbon monoxide.**

After term birth, the ductus arteriosus undergoes spontaneous active constriction and eventual obliteration by day of life 3 secondary to the increase in oxygen tension after delivery, which causes increase of intracellular calcium in the smooth muscle cells at the level of the ductus triggering its contraction. In preterm infants, however, PGE<sub>2</sub> remains high and may inhibit the action of elevated levels of oxygen on ductal smooth muscle. The ductus arteriosus remains patent at day of life 4 in around 80% of infants born at 25 to 28 week and 90% of infants born at 24 weeks, making this population at greater risk for PDA.

Closure of the ductus still remains a controversial topic. Infants born at 28 weeks of gestation and younger are at greater risk for IVH and pulmonary hemorrhage, however it is still unknown if this is secondary to the PDA. It has been proposed that patency of a ductus which becomes hemodynamically significant is associated with comorbidities including prolongation of assisted ventilation and higher rates of death, bronchopulmonary dysplasia (BPD), pulmonary hemorrhage, necrotizing enterocolitis (NEC), impaired renal function, IVH, periventricular leukomalacia, and cerebral palsy. The left to right shunting of blood through the patent ductus is believed to cause a diastolic steal away from the aorta into the pulmonary artery, increasing pulmonary blood flow and decreasing perfusion to systemic circulation, thereby increasing comorbidities.

A physiologically stabilized ductus may eliminate this phenomenon and enhance systemic blood flow.

Different treatment strategies have been proposed, including prophylactic therapy, early targeted therapy, symptomatic treatment or conservative management. The most commonly used pharmacologic agents for the closure of the PDA are indomethacin and ibuprofen. These agents inhibit the cyclooxygenase (COX) site of the prostaglandin synthase enzyme by competition with arachidonic acid. This way, the activity of the PGE<sub>2</sub> synthetase is decreased, thereby reducing circulating levels of PGE<sub>2</sub> and facilitating the closure of the ductus.

Pharmacologic closure of the PDA has been associated with improved fluid clearance from the lungs in baboon models via improved expression of ENaC channels possibly due to the inhibition of the COX site by indomethacin and ibuprofen, rather than the closure of the ductus itself. It has also been associated with improved lung alveolarization.

The recent PDA-Tolerate trial showed that symptomatic closure of the PDA at 8-14 days doesn't decrease incidence of PDA or its comorbidities. However, early closure by prophylactic or early targeted therapy in the first 8 days of life has been associated with decreased incidence of severe IVH, pulmonary hemorrhage, ventilatory support at the end of the first week of life, and vasopressor dependent hypotension. The incidence of BPD after indomethacin prophylaxis still remains controversial. The fact that early closure has shown better outcomes raises the question as to whether there is a window in the first 8-10 days following preterm birth after which persistent exposure to a PDA increases comorbidities.

*Continued on page 3...*

# Importance of Addressing Perinatal Mood and Anxiety Disorder to Reduce Maternal Mortality

**Maternal mortality in the US is a health care crisis. Although maternal mortality has been a priority, the US has seen an increase whereas countries worldwide have seen a significant decrease.**

Did you know that maternal suicide exceeds hemorrhage and hypertensive disorders as a cause of maternal mortality? Did you know that postpartum depression is the most common complication of childbirth occurring in 10-20% of women? 1 in 10 fathers also suffer from postpartum depression. What has been surprising is that treatable perinatal mood and anxiety disorders, including depression, contribute to the alarming maternal mortality rates in the US. Perinatal depression which includes major and minor depressive episodes that occur in pregnancy or the first 12 months after delivery, is one of the most common complications during pregnancy and postpartum period affecting 1 in 7 women.

The American College of OB/GYNs has created a maternal mental health supporting bundle to give providers a systematic way of addressing mental health in the perinatal/postpartum period through: readiness, recognition, response and reporting. One of the most important things is for providers to screen patients for depression and anxiety at least once during the perinatal/postpartum period. This screening can be done at the comprehensive postpartum visit or antenatally; however if done during the pregnancy additional screening must be done again at the postpartum visit. In 2016 the US Preventative Task Force also recommended screening for depression in pregnant and postpartum women as well as the general population. The most common validated screening tool used is the Edinburgh Postnatal Depression Scale. This screening tool has only ten questions, takes less than five minutes to complete and specificity and sensitivity to detect depression between 50-100%. The Edinburgh has been translated into over 50 languages. Multiple studies have shown that screening alone can have clinical benefits. One randomized controlled trial noted that 15 minutes of anticipatory guidance before hospital discharge followed by a phone call at 2 weeks reduced depression symptoms and increased breastfeeding duration for six month among African American and Hispanic women. Different collaborative care models have been proposed to help address the paucity of behavioral health services and improve long term patient outcomes for mental health. One example is upskilling of nurses and social workers to enhance the availability and access to much needed psychotherapy and support services for patients.

There are multiple resources available for patients suffering with perinatal mood and anxiety disorders. Some examples are Postpartum Support International, Lifeline 4 Moms, and Postpartum Resource Center of New York. Postpartum support international, founded in 1987, provides a vast amount of resources and services to providers and patients. Their purpose is to increase awareness among public and professional communities about the emotional changes that women experience during pregnancy and postpartum. PSI New York has dedicated support coordinators for New York statewide and individual counties including Westchester, Putnam, Rockland, Dutchess and Ulster. Lifeline 4Moms, founded by Drs. Byatt and Simas from the University of Massachusetts, has established a population based program to address perinatal depression in primary care settings. This program has received a 2.5 million dollar award from the CDC to evaluate, refine and disseminate a sustainable stepped care program in OBGYN outpatient settings to improve perinatal women's mental health, health treatment rates and outcomes. Lastly Postpartum Resource Center of NY is open 7 days a week from 9am-5pm. They provide moms and dads free non-judgmental and confidential emotional support as well as educational information and support group resources. Here at WMC, through a collaboration of the Telehealth and Obstetrics departments we are creating a telehealth maternal mental health program that will be offering network wide resources and services to moms and families of the Hudson Valley – providing the care and support they need close to home .

Perinatal mood and anxiety disorders are common diagnoses that are important to screen for and treat when trying to bring down the maternal mortality rate in the US. Their recognition can be life-saving for a new mom and her family. It is imperative for providers in primary care settings to screen all women at least once during the perinatal/postpartum period. Multiple collaborative care models have been proposed and can be replicated. Increasing awareness for moms and providers is the first step. In order to increase awareness for maternal mental health, WMCHHealth participated in a world day to focus attention and awareness on May 5, 2021 – “World Maternal Mental Health Day”.

*References available upon request.*

**Sadaf Lodhi DO FACOG**, Clinical Assistant Professor of OBGYN, Telehealth/Laborist, WMC ([Sadaf.Lodhi@wmchealth.org](mailto:Sadaf.Lodhi@wmchealth.org))

## Indomethacin Prophylaxis for Closure of the PDA *Continued from page 2*

Multiple studies have shown that 3 doses of indomethacin given prophylactically starting in the first 12-24hrs of life in preterm infants decrease the incidence of PDA, need for consecutive medical or surgical ligation and severe IVH. Moreover, more recent studies have shown that single dose indomethacin prophylaxis effectively closes the PDA, as well as decreases need for consecutive symptomatic treatment. Compared to placebo, there was a decrease in severe IVH. On long term follow up, there was better motor development and less incidence of CP. The main concern with given studies is that most were retrospective, with uncertainty for proper matching of patients and possibility of overestimation of outcomes.

Even though controversy still exists as to whether to treat the PDA or not, special attention should be given to infants bellow 28 weeks, the population more at risk for comorbidities associated with a PDA.

More prospective randomized controlled trials are needed in order to corroborate the beneficial effect of prophylactic closure of the PDA. Our RNICU screens preterm infants weighing less than 1 kg at 3-5 days of life for the presence of a large PDA with left-to-right flow, and treats with ibuprofen, even prior to hemodynamic changes. Our experience with PDAs in these preterm infants is being prepared for publication.

*References available upon request.*

**Maria Cristina Fernandez, MD**, Neonatal Fellow, WMC  
[MariaCristina.Fernandez@wmchealth.org](mailto:MariaCristina.Fernandez@wmchealth.org)

**Lance Parton, MD, FAAP**, Attending Neonatologist, WMC  
[lance.parton@wmchealth.org](mailto:lance.parton@wmchealth.org)

# Welcome to WMC's Perinatal Team

## Dr. Meenakshi Singh, MBBS, FAAP

Dr. Meenakshi Singh has joined the division of Neonatal Perinatal Medicine at WMC as the Director of Neonatal Quality Improvement.

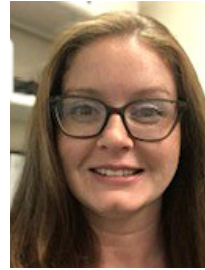


She is an Assistant Professor of Pediatrics. She completed her pediatrics residency and neonatal-perinatal medicine fellowship from Maria Fareri Children's Hospital and New York Medical College,

New York. She was a faculty at Penn State Medical Center for about five years. She is board certified in pediatrics and neonatal-perinatal medicine. She was recognized by the Pennsylvania Medical Society as one of the "Top Physician in the State of Pennsylvania" under 40 for the year 2019. She is currently attending a certificate course in Quality Improvement & Patient Safety from Johns Hopkins University Bloomberg School of Public Health.

## Jeanette Diaz, BSN, RNC

Please join us in welcoming Jeanette Diaz to the Regional Perinatal Center (RPC) team as our new RPC Coordinator.



She received her Bachelor's degree from the College of Mount Saint Vincent in 2008. She has been a nurse in the NICU at Maria Fareri Children's Hospital at Westchester Medical Center for 13 years. During that time, Jeanette has served as charge nurse,

precepted new nurses and attained certification in Extremely Low Birth Weight and Neonatal Intensive Care Nursing. Jeanette also has two young daughters whom she delivered at a local community hospital and had a stay in their NICU; this provides additional perspective from a mother's point of view. She joins the RPC with a goal of ensuring our region's mothers and babies have the best experiences and outcomes. Jeanette also looks forward to promoting nursing education, fostering regional collaboration and maintaining excellent communication across the network's facilities.

## Rachel Feurstein, MPH

Please join us in welcoming Rachel Feurstein, MPH to Regional Perinatal Center (RPC) team as our new Data Analyst.



Rachel received her Bachelor's Degree in Biology at Binghamton University in 2018 and her MPH in Epidemiology and Biostatistics

from CUNY Graduate School of Public Health and Health Policy in 2021. She worked as a research assistant for the New York City Physical Activity and Redesigned Community Spaces (NYC PARCS) study and studied how sociodemographic and psychosocial characteristics can predict Ecological Momentary Assessment (EMA) response to physical activity surveys. She is excited to meet and work with everyone in the region.



## Congratulations Dr. Shetal Shah AAP 2020 Outstanding Chapter Award

Under the leadership of President, Dr. Shetal Shah MD FAAP, New York Chapter 2 of the American Academy of Pediatrics received the 2020 Outstanding Chapter Award in the "Large Chapter Category" at a virtual ceremony earlier this month. The win, which comes after 13 nominations in the past 28 years, is the first for the chapter in 57 years. The chapter won the inaugural award in 1964.

Dr. Shah, a neonatologist at Maria Fareri Children's Hospital in Valhalla, NY and a Clinical Professor of Pediatrics at New York Medical College, led the chapter in its local response to the COVID pandemic. The chapter was noted for its advocacy – pushing back against cuts in Medicaid coverage for children and helping to achieve a statewide ban on the sale of flavored nicotine products, which can entice children to vape. To meet needs of pediatricians, many of whom faced practice challenges during the statewide quarantine, the chapter hand-delivered over 10,000 pieces of Personal Protective Equipment.

## State Perinatal Database Team & Perinatal Gazette Editorial Board

**Jeanette Diaz**, BSN, RNC, Editor,  
Regional Perinatal Center Coordinator  
914.493.8590  
jeanette.diaz@wmchealth.org

**Sean Tedjarati**, MD, MPH, MBA  
Director, Department of OB/GYN,  
NYMC, WMC Health Network  
914.493.2181  
sean.tedjarati@wmchealth.org

**Geetha Rajendran**, MD, FACOG,  
Maternal Fetal Medicine, Department  
of Obstetrics and Gynecology  
914.493.2246  
geetha.rajendran@wmchealth.org

**Edmund LaGamma**, MD, FAAP,  
Director Newborn Medicine &  
Regional Perinatal Center  
914.493.8558  
edmund\_lagama@nymc.edu

**Heather Brumberg**, MD, MPH, FAAP,  
Associate Director  
Regional Perinatal Center  
914.493.8491  
heather\_brumberg@nymc.edu

**Desmond White**, MD, FACOG,  
Maternal Fetal Medicine,  
Dept. OB/GYN  
914.493.2250  
desmond.white@wmchealth.org

**Rachel Feurstein**, MPH, Data Analyst  
914.493.8346  
rachel.feurstein@wmchealth.org

**Christine Janeczko**, BA  
SPDS & Outreach Specialist  
914.493.8309  
christine.janeczko@wmchealth.org



**Westchester  
Medical Center**

Westchester Medical Center Health Network



**Maria Fareri  
Children's Hospital**

Westchester Medical Center Health Network

Published with support of gifts in memory  
of Jacob and Samuel Russin