



# Neonatal News

Summer 2010

Neonatology at The Children's Hospital of Philadelphia

## CHOP Launches Multidisciplinary Neonatal Airway Program



Ian Jacobs, M.D.



Karen Zur, M.D.



Luv Javia, M.D.



Janet Lioy, M.D.

Hundreds of infants are sent to CHOP each year for evaluation and treatment of respiratory failure and other conditions that affect the airway.

These patients and their families can benefit from CHOP's Neonatal Airway Program, a first-of-its-kind, multidisciplinary program dedicated to the evaluation and treatment of neonates and infants with life-threatening airway disorders.

Directed by Ian Jacobs, M.D., medical director of the Center for Pediatric Airway Disorders, and Janet Lioy, M.D., attending neonatologist in the Division of Neonatology, the program comprises staff from Genetics, Neurology, Neonatology, ENT, Plastic Surgery and other disciplines. The team's three surgeons — Jacobs, Luv Javia, M.D., and Karen Zur, M.D. — have extensive experience with tracheostomy, palatal surgery, airway reconstruction and bronchoscopy, which can be performed in one of CHOP's specially equipped ENT operating rooms or at the patient's bedside. Two full-time neonatal nurse practitioners arrange transports, meet with families, liaise with attending physicians and coordinate all aspects of a patient's care. And the team is adding another surgeon later this summer.

Neonates with airway problems benefit immensely from receiving such expert and comprehensive care so early in their lives. "We're not picking up the pieces later on," Jacobs says. "We have a great, multidisciplinary approach, with all the different specialists in one hospital. And everybody's at the top of their game."

"Everything is under one roof," says Lioy. "There is no other airway program with this level of coordinated, high-level expertise."

### Critical airway evaluations:

- choanal malformations/stenosis/atresia
- tracheal/subglottic stenosis and tracheostomy
- severe micrognathia (Goldenhar and Treacher Collins syndromes)
- neck masses and airway hemangiomas
- swallowing disorders and vocal cord dysfunction/paralysis
- laryngeal/tracheal malacia



The Neonatal Airway team often treats sacular cysts (left), airway hemangiomas (center) and subglottic stenosis (right).

The team's expertise is especially invaluable for patients with difficult diagnoses like pyriform aperture stenosis, which is often mistaken for choanal atresia. Because pyriform aperture stenosis can have specific genetic and syndromic implications like holoprosencephaly, early and accurate diagnosis is critical.

"The CT scan can be misleading and the repair is often different from choanal atresia," says Lioy. "Neonatal ENT expertise can make a difference in evaluation, diagnosis and treatment."

# Making the Neonatal Intensive Care Unit a Safer Place

A month without a central line-associated bloodstream infection (CLABSI) is cause for celebration in any intensive care unit. In the last year, CHOP's Harriet and Ronald Lassin Newborn/Infant Intensive Care Unit has celebrated that accomplishment twice (*see chart below*).



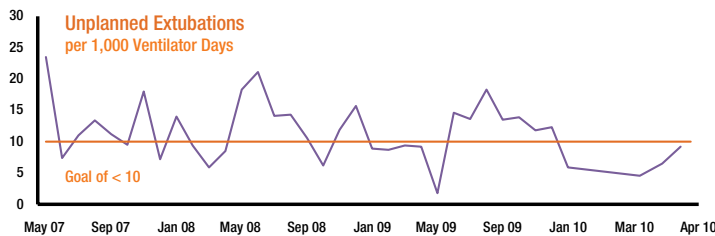
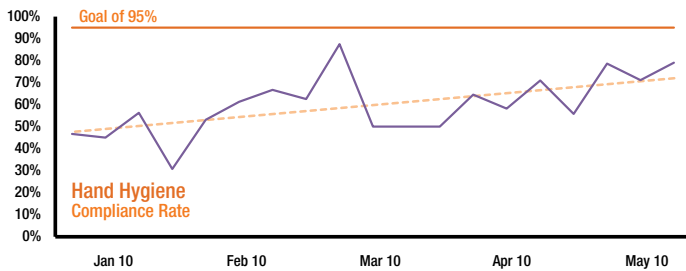
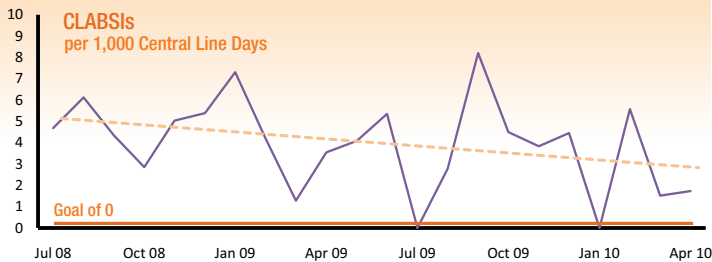
John Chuo, M.D.

It's just one testament to the continuing success of the N/IICU's quality improvement efforts, led by John Chuo, M.D., M.S. Chuo relies on input from bedside nurses, physicians, pharmacists, respiratory therapists and other staff to guide the work, which he describes as a team effort.

What the team has learned could be useful to any NICU that is trying to improve quality and safety.

"We've learned that there are certain things that we do that work, such as standardizing processes and increasing vigilance," says Chuo. "We've learned to focus on communication and that we need actionable data."

## N/IICU Safety Data



The N/IICU's quality and safety work centers on three main areas:

- **Decreasing the central line-associated bloodstream infection rate:** The team is working to increase hand hygiene compliance among staff and among patients' family members.
- **Preventing unplanned extubations:** All N/IICU providers now use the same method for taping endotracheal tubes. The early data is promising, but there is still work to be done (*see chart below*).
- **Reducing prescribing errors:** The team is analyzing data on all prescribing errors and reporting it to frontline physicians quickly.

A popular screen saver program has been integral to the unit's quality and safety work, helping to facilitate communication and empowering staff to champion safety. The idea is simple: bedside nurses and leaders submit ideas for screen savers that are displayed on computer monitors throughout the department (*see example below*). It's a more visual way to disseminate important safety information quickly and easily. Many N/IICU nurses say the program has made the unit safer.

Chuo emphasizes that none of the unit's initiatives would be possible without the support of both frontline staff and Hospital leaders, who have made improving patient safety an institutional priority.

"We're headed in the right direction," he says. "Quality work really has no end."

## A Screen Saver Used in the N/IICU

Is your patient's ETT being moved frequently?



Have the team discuss on rounds and examine consecutive xrays before moving the tube again.

# New Bone Health Program for Neonates

Many older preterm infants with chronic, debilitating medical problems are referred to the N/IICU for evaluation of feeding difficulties, bowel dysfunction, pulmonary insufficiency and airway compromise. Many of these infants have had poor nutrition due to their medical/surgical conditions and have received various diuretic and steroid medicines — all factors that adversely affect their bone and mineral metabolism and place them at increased risk for osteopathy of prematurity. Additionally, during their time in the N/IICU, some of these infants experience fractures, often occult fractures that are only identified on incidental X-rays, which causes much distress and confusion for their families.



Michael Levine,  
M.D.

CHOP's new, first-of-its-kind Bone Health Program for neonates identifies infants who are at high risk of bone problems and provides them with highly specialized care, with the goal of reducing fractures both in the N/IICU and after discharge. The program is directed by Michael Levine, M.D., chief of the Division of Endocrinology and director of the Center for Bone Health, in collaboration with the Division of Neonatology.

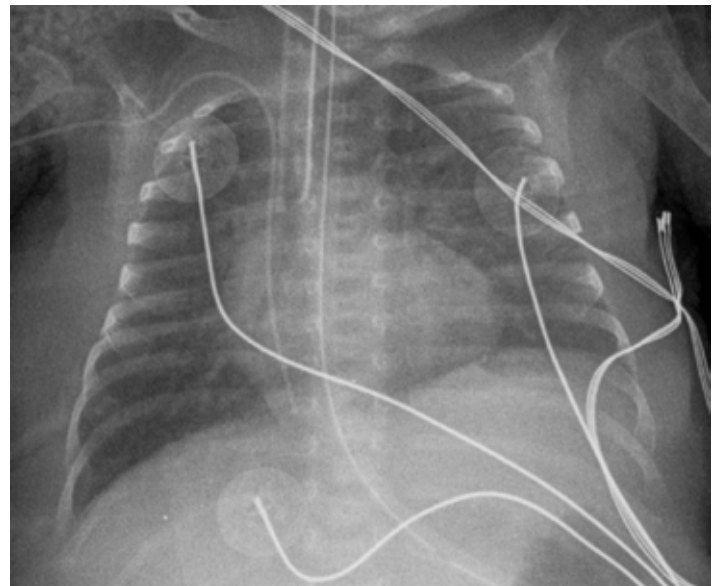
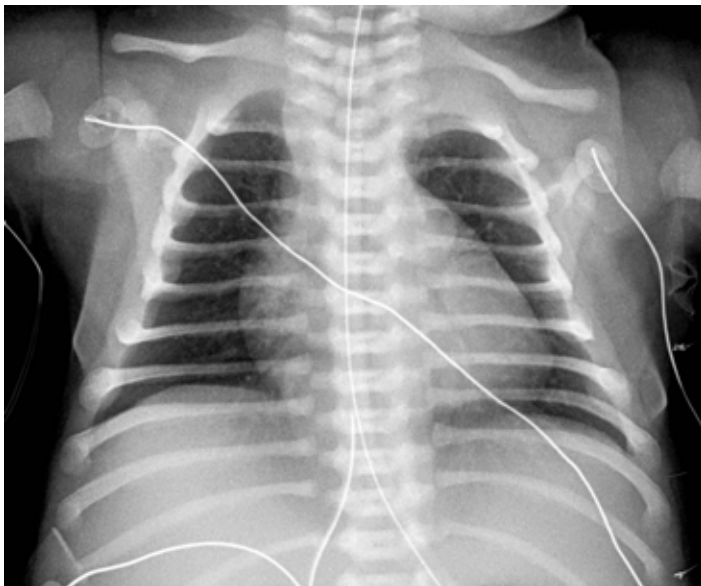
*Highlights of the program include:*

- Weekly “Bone Rounds” in the N/IICU are conducted by a group of “bone health” clinicians headed by

Levine and including neonatal attendings and fellows, neonatal nutritionists, neonatal physical therapists and a pharmacist.

- A specially developed clinical algorithm is used to identify infants at significant risk of fracture. Specific biochemical tests are performed weekly to assess vitamin D status (e.g., 25-hydroxyvitamin D and PTH) and mineral metabolism (e.g., serum and urine calcium and phosphorus, bone-specific alkaline phosphatase). Skeletal imaging is used to confirm suspected bone problems. These analyses are used to develop individualized and comprehensive care plans that optimize calcium and phosphorus intake to maintain physiological parathyroid gland function.
- Treatment is tailored to each patient, and patients are monitored closely for improvements in bone health.

Optimizing bone health in preterm infants has the potential to provide significant — perhaps even lifelong — benefits. Randomized trials have shown short-term benefits of specific nutritional interventions on bone mass and fractures in preterm infants, and some clinicians believe that maximizing peak bone mass — the bone mass reached at skeletal maturity — is an important strategy for reducing later osteoporosis risk. More work needs to be done to determine the role specific pharmacological interventions with highly potent forms of vitamin D play in optimizing these patients' early and later bone health.



*Clinicians in the N/IICU's Bone Health Program identify infants who are at high risk of bone problems and provide them with highly specialized care, with the goal of reducing fractures in the N/IICU and after discharge. The X-ray on the left shows an infant with healthy bones; the one on the right shows an infant with osteopenia.*

# CHOP Uses Novel Approach to Treat Complex Infantile Hemangiomas

Infantile hemangiomas that arise near the airway, close to the eye or on cartilaginous structures like the ear or nose need prompt treatment. Systemic corticosteroids have long been the mainstay of treatment for these and other complex infantile hemangiomas, but they often can only slow the growth of the lesion. And they can occasionally cause side effects such as hyperglycemia, hypertension, immune suppression and growth delay.



*Albert Yan, M.D.*

The Children's Hospital of Philadelphia offers a new option. A group of clinicians led by Albert Yan, M.D., chief of the Section of Dermatology, are using propranolol, a beta-blocker, as an off-label alternative to treat certain complex infantile hemangiomas — and they're seeing dramatic results.

Some hemangiomas begin to regress after just a few days of treatment with propranolol, and significant regression has occurred with as little as three weeks of therapy. Propranolol has also been successfully used to treat visceral hemangiomas, as well as noncritical hemangiomas that do not respond to conventional therapy.

Some of the best results, Yan notes, have been obtained with airway hemangiomas that occlude the trachea. "We've seen dramatic responses, going from about 60 percent occlusion to, a week later, 20 to 30 percent occlusion, which is pretty rapid," he says. "These are kids who may be at risk for respiratory compromise, who might need a tracheotomy to help them maintain their airway, and instead we've been able to use these medications to pharmacologically reduce all of this obstruction." Many of the children who are initially started on corticosteroids can be tapered off once a favorable response is established with propranolol.

Propranolol is known to be well-tolerated, even in the youngest infants. Doctors have safely used it to treat cardiac

conditions in infants and older children for years, says Yan, noting that his team worked closely with Cardiology to develop the hemangioma protocol.

The drug is administered orally, and treatment is initiated in an inpatient setting. Babies age 3 months and younger are typically admitted to the N/IICU, where, over the course of three days, their dosage is rapidly uptitrated until they reach the therapeutic dose. They are closely monitored for complications throughout their stay. Most babies remain on the therapy, as outpatients, for three to nine months.

Yan's team has treated more than four dozen hemangioma patients with propranolol so far. "One advantage of our program is the degree of experience we now have using the drug," he says. Another advantage: Patients have immediate access to subspecialists from Neonatology, as well as Cardiology, ENT, Ophthalmology, Neurology, Plastic Surgery and other disciplines.

"We have all of the attendant services that can benefit these kids, all in one place," says Yan.

In March, Yan's team also began enrolling patients in an international multicenter clinical trial that is studying the outpatient use of propranolol to treat patients with uncomplicated hemangiomas. Patients enrolled in the placebo-controlled trial will receive all of their treatment on an outpatient basis, with dose escalation occurring over a more gradual three-week period.



*This patient's ocular hemangioma all but disappeared after seven weeks of treatment with propranolol.*



*CHOP's N/IICU is growing. The unit, which currently has 70 beds, will add five more this fall.*

# Case Study: A Mysterious Rash

**Prenatal History:** 41-week female born to a 38 y/o G2P0 via an IVF conception with a vanishing twin at 6 – 8 weeks. There was no history of HSV or fevers during pregnancy, but mom had blistering rash between her fingers during summer months of pregnancy.

**Delivery:** Induction for post dates with a C/S for failure to progress. At birth, infant was noted to have vesicular/pustular lesions on arms and R leg. At 40 hours, she was noted to have tonic-clonic movements of L arm and leg and an EEG revealed seizure activity.

**Referring Hospital Course:** Initial tonic-clonic L-sided seizures, becoming more generalized on DOL 3 lasting 30 s – 4 min. A total of 40 mg/kg phenobarbital and a 20 mg/kg load of Dilantin were given. HUS revealed bilateral Grade 1 IVH. Patient referred to CHOP for evaluation and treatment.

**CHOP Course:** EEG revealed abnormal spike wave activity in R frontal region, spread to L side. Patient placed on video EEG and continued to have seizure activity. Head CT revealed hypodensities within white matter of R frontal lobe, extend to cortex, watershed infarction. MRI revealed small infarctions through cortex, nonocclusive sagittal sinus thrombosis. Multifocal nonarterial distribution most consistent with vasculitis or metabolic condition. Vesicular rash progressed to scabbing of lesions on DOL 3. Patient continued on ampicillin, gentamicin and acyclovir. Normal CBC, CSF and skin PCR; all negative for herpes and varicella. No further clinical seizures noted. Patient continued on phenobarbital. Rash worsened DOL 4. Dermatology consulted to rule out epidermolysis bullosa.



## Questions:

1. What is the differential diagnosis of this rash?
2. Ruling out all infectious causes, what are the most likely dermatologic conditions?
3. What are the genetics of this condition?
4. What is the significance of a “vanishing twin”?
5. How will the skin findings change with age?
6. What is the significance of the seizures? Are other neurologic problems associated with this condition?

1. vesiculopustular rash in the neonate  
 Viral: VZV, HSV, CMV, Coxsackie  
 Bacterial: Staph pyoderma (S. aureus), SSSS (3-7 days), strep, listeria  
 Other: syphilis (bullae/percehia soles and palms), fungal, scabies (3-4 weeks)
2. Congenital
- Epidermolysis bullosa
  - Epidermolytic hyperkeratosis (raw erosions at birth)
  - Aplasia cutis congenita (can involve ext and trunk)
  - Incontinentia pigmenti (IP)
  - Cutaneous mastocytosis
  - Pustular melanosis
3. Incontinentia pigmenti (IP) is an X-linked dominant neurocutaneous syndrome with cutaneous, neurologic, ophthalmologic and dental findings. Over 80 percent of the time, there is a large deletion of something called the “*NEMO* gene,” which is responsible for ensuring viability in skin cells. A family history of IP in the mother is reported to occur in 28 percent of patients. Most cutaneous findings present at birth or within the first 2 weeks of life.
4. IP is lethal in most, but not all, males, which mostly occurs as a fetal death.
5. IP has four clinical states, ranging from erythema and vesicles to hyperkeratosis, progressing to hyperpigmentation (3-6 months) and finally to hypopigmentation (late infancy).
6. Cerebral atrophy, cortical necrosis and subcortical and infarction/hemorrhage, transient white matter injury can all be seen with IP.

## Answers:

*Continued on back panel*

## Discussion:

Incontinentia pigmenti (IP), also known as melanoblastosis cutis, Bloch-Sulzberger disease and Bloch Siemens syndrome, is a neurocutaneous disorder characterized by abnormal skin pigmentation. IP also affects the eyes, hair, teeth and nails.

- 80 percent have systemic findings
- Dental (peg teeth), neuromuscular (scoliosis), ocular and neurologic abnormalities are common
- Skin abnormalities associated with IP include blistering, a distinctive rash, swirling macular hyperpigmentation and linear hypopigmentation

## Neonatal Findings

- Vesicular rash
- Refractory seizures
- Paresis
- Unusual: PPHN, alopecia

## Neuro and Ophtho Findings

- Cerebral atrophy, cortical necrosis and subcortical hemorrhage, transient white matter injury
- Slow motor development in up to 20 percent, weakness
- Retinal vascular changes
- Retinal detachment, cataract, microphthalmia

The prognosis depends on the presence and severity of associated extracutaneous manifestations. Morbidity and mortality primarily result from neurologic and ophthalmologic complications, including mental retardation, seizures and vision loss.

## CHOP Newborn Care Update

Through CHOP Newborn Care, the Division of Neonatology provides comprehensive care in the intensive care nurseries of eight community hospitals in the Delaware Valley (*see map at right*).

We are pleased to announce new staff appointments at several of our Newborn Care locations:

**Carrie Hufnal-Miller, M.D., F.A.A.P.**, has joined the University Medical Center at Princeton as director of Neonatology.

**Catherine Myers, M.D., F.A.A.P.**, has joined Shore Memorial Hospital as director of Neonatology.

**Mark Takashi Ogino, M.D.**, has joined the Chester County Hospital as director of Neonatology.

**Ira Wertheimer, D.O.**, and **Tomas Rotschild, M.D.**, have joined Shore Memorial Hospital as attending neonatologists.

## Calendar of Events

### Advances in Neonatology — Full-day CME

Wednesday, Oct. 13, 2010

The Children's Hospital of Philadelphia

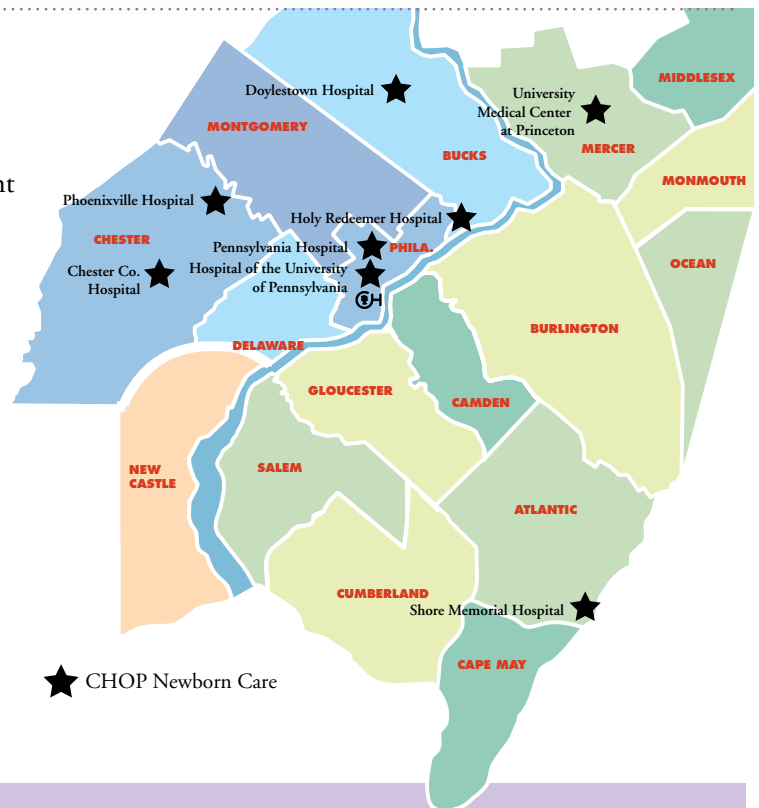
For more information: 215-590-2616

#### Featured Speakers:

Steven Abman, M.D.: "The New Bronchopulmonary Dysplasia: How Is it Different?"

Martin Keszler, M.D.: "Neonatal Ventilation: High Frequency, Low Frequency and No Frequency"

Ronald Wapner, M.D.: "Corticosteroids in Pregnancy: Are Repeated Doses Useful?"



★ CHOP Newborn Care

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Janet Lioy, M.D.

#### Contact Us:

For transport, call 215-590-3083.

For more information, visit [neonatology.chop.edu](http://neonatology.chop.edu).