



# Pediatric Clips

**NURSING**

## Recognizing and treating hydrocephalus in infants and children

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Jan. 2008 • Volume 1

Pediatric Nursing Clips by Pediatric Advanced Practice Nurses at Dayton Children's provides quick reviews of common pediatric conditions.

The Children's Medical Center of Dayton is the region's pediatric referral center for a 20-county area. As the only facility in the region with a full-time commitment to pediatrics, Dayton Children's offers a wide range of services in general pediatrics as well as in 35 subspecialty areas for infants, children and teens. We welcome your inquiries about services available – call 937-641-3666 or e-mail marketing@childrensdayton.org.

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### CASE STUDY

Mary is a 4-month-old who presents to the ED with a history of prematurity and intraventricular hemorrhage (IVH). Her mother reports a three-day history of irritability, vomiting and not acting like herself. The mother states she is often told Mary's head is big and her soft spot is sticking up.

#### DIAGNOSTIC WORKUP

At discharge from NICU, neuroimaging shows resolving grade III IVH

and mildly dilated ventricles with no overt hydrocephalus. In comparison imaging on ED presentation shows increasingly enlarged ventricles. Neuroimaging used for diagnosis of hydrocephalus may include ultrasound (with open fontanel) or CT without contrast.

Mary's head circumference is currently 46 cm, which now plots higher on the growth curve, above the 98th percentile. Her fontanel is found to be full and tense. On examination,

Mary has a fixed downward gaze, also known as *sunsetting eyes*. Laboratory findings: BMP, CBC, CRP and urinalysis were all within normal limits.

#### DIAGNOSIS

Acquired hydrocephalus secondary to grade III intraventricular hemorrhage (IVH).

#### TREATMENT

Permanent diversion of cerebral spinal fluid (CSF) with placement of a ventriculoperitoneal shunt.

### CASE DISCUSSION

Hydrocephalus is a condition where there may be a lack of absorption, over production or blockage of flow of the cerebral spinal fluid (CSF) that is made inside the ventricles (fluid-filled areas) of the brain. Hydrocephalus may be present at birth (congenital) or may develop later in life, referred to as acquired. Common causes of acquired hydrocephalus are IVH of prematurity, infection, traumatic or nontraumatic subarachnoid hemorrhage and brain tumor.

Communicating hydrocephalus occurs when the ventricular system is open, but the arachnoid villi, which reabsorb CSF back into the venous system, are blocked (ie, hemorrhage or infection). Noncommunicating hydrocephalus occurs when there is a physical obstruction within the ventricles (ie, congenital block or brain tumor).

Hydrocephalus occurs in approximately one out of every 500 births. The risk of developing hydrocephalus after IVH, is 20 to 70%. Patients with grade I or II hemorrhage do not develop hydrocephalus secondary to their hemorrhage. However, grade III have a 55% chance and grade IV have an

80% chance of developing hydrocephalus. IVH originates from the germinal matrix, a very vascular, biologically active region in the infants brain. In the term infant the most common cause is spina bifida. Delayed onset of hydrocephalus in infancy is more likely due to a congenital finding of aqueductal stenosis, the narrow channel between the third and fourth ventricles.

The goal of treatment for hydrocephalus is temporary or permanent diversion of the cerebrospinal fluid. Temporary diversion of CSF is accomplished with use of ventricular access device (VAD), or placement of an external ventricular drain, until the child's weight, overall health and possible blood clot has resolved. Placement of a shunt is a permanent diversion method. The shunt consists of three components: a catheter placed into the ventricle, a one-way pressure regulated valve and a distal catheter that may be placed in the peritoneal cavity, the heart or the pleural space, where CSF is reabsorbed.

In a select number of cases of noncommunicating hydrocephalus an endoscopic third ventriculostomy (ETV)

may be the surgical intervention of choice. This procedure does not leave a shunt behind, but allows the CSF to divert through an opening in the third ventricle and out to the normal subarachnoid space.

#### COMPLICATIONS

Shunt failure rate is approximately 45% to 60% the first year following placement and it is not uncommon for patients to have multiple revisions during their lifetime. Common reasons for failure of shunting include infection, obstruction and disconnection.

A child in shunt failure presents with findings of increased intracranial pressure. Increased intracranial pressure causes a very stereotypic set of symptoms dependent on the child's age. Newborn or infants may experience a bulging of the fontanel, increasing head circumference (expansion of the open cranial sutures due to pressure), irritability, poor feeding, vomiting, scalp vessel distension, sunset eyes, episodic bradycardia, apnea and excessive sleepiness. Symptoms of increased intracranial pressure in older children may include headache, vomiting,

Continued

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irritability, change in personality, change in cognition, lethargy, hypersomnolence, incoordination and gait disturbance.

Signs of infection may include fever, irritability, lethargy, erythema at insertion site or tracking along shunt tubing

### OUTCOMES

Outcomes and prognosis of children with hydrocephalus depend on the etiology of hydrocephalus and span a wide continuum

from normal to mild, or very severe deficits. These may include: psychological deficits, motor skill or visual difficulties, seizures, memory deficits or learning disabilities.

The shunted hydrocephalus patient requires lifelong neurosurgical follow-up visits.

### REFERENCES

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## FEATURED NURSE SPECIALISTS



**SHERRY KAHN, MS, RN, CPNP,** received her master's degree from Wright State University. She holds certification as a pediatric nurse practitioner (PNP) and prac-

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