

# NewYork-Presbyterian Morgan Stanley Children's Hospital Focus on Pediatric Neurosurgery

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## INSIDE SUMMER 2010

**2** **Meet the Physician**  
Saadi Ghatan, M.D.  
**Patient Profile**  
Erica R.

**4** **Contact Information**

## Internal Cranial Expansion Procedure

Doctors at the Pediatric Neurosurgery Center are having tremendous results using a procedure called Internal Cranial Expansion (ICE) to help children with recalcitrant high pressure conditions of the brain.

Normal pressure in the skull is regulated by the flow of Cerebrospinal Fluid (CSF). CSF is made continuously by the brain and then returned to the heart. It provides nutrition and serves as a cushion for the brain and spinal cord in a carefully regulated, closed system.

Any number of problems including, a birth defect, a tumor, an infection, or bleeding can cause an interruption in this system and cause fluid, and therefore pressure, to build up.

The best solution is to take care of the original problem that is causing the imbalance. In some cases however, the source cannot be found. Doctors call this Idiopathic Intracranial Hypertension (IIH). IIH can also be referred to as Pseudotumor Cerebri (Cerebri refers to the brain and pseudotumor means that it is acting like a tumor).

Pseudotumor is most common in obese females and the symptoms include headaches, nausea, and vomiting. The increased pressure can also damage nerves, particularly those that effect vision (a condition called papilledema).

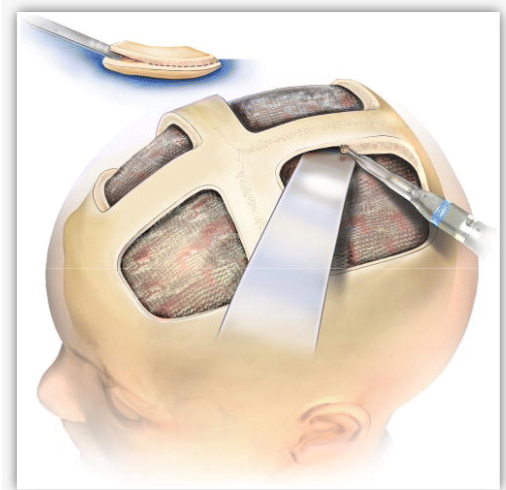
To relieve the pressure build up, surgeons usually employ a shunt, or one-way valve, to drain off CSF. Shunts can be placed inside the brain or in the lumbar spine CSF and usually route excess fluid into the abdominal cavity where it can be absorbed by the body.

Unfortunately shunts aren't always perfect. In some cases they fail and/or become infected in others, high or low pressure and resultant symptoms persist even when the shunts are working fine.

When this happens, other options need to be considered. Surgeons at the Pediatric Neurosurgery Center have found that a specific procedure called Internal Cranial Expansion, can be very effective in solving the problem.

Internal Cranial Expansion (ICE), a procedure that was pioneered at the Morgan Stanley Children's Hospital of New York (CHONY), is very simple in principle; surgeons remove bone from the inner skull to increase the size

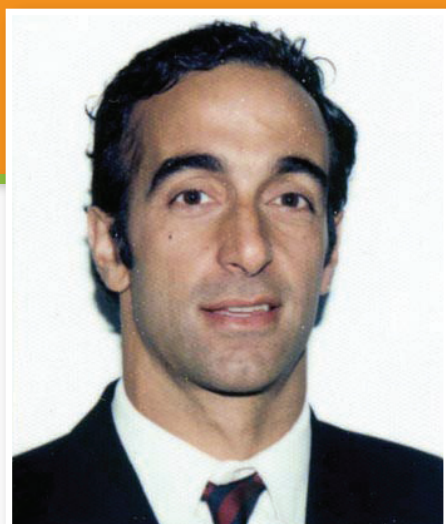
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*Schematic diagram depicting the process of calvarial thinning following removal of four large craniotomies. Calvarial struts bordering the left anterior craniotomy site have been thinned, and those bordering the left posterior site are being thinned with a drill. A free bone flap is thinned using an osteotome.*

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## Meet the Physician Saadi Ghatan, M.D.

Saadi Ghatan, M.D., is a board certified Pediatric Neurosurgeon, member of the American Society of Pediatric Neurosurgery, and Fellow of the American College of Surgeons. He is the Florence Irving Assistant Professor of Neurological Surgery at Columbia College of Physicians and Surgeons and Attending Pediatric Neurosurgeon at Children's Hospital of New York Presbyterian. Dr. Ghatan is a cum laude graduate of Princeton University, and went on to graduate with Honors and election to Alpha Omega Alpha from the University of Washington in Seattle. He

completed his internship in General Surgery at the University of Washington in 1994, and was a resident in Neurosurgery at the University of Washington from 1994-2001. During this time, he also served as Senior Registrar at Atkinson Morley's Hospital in Wimbledon, England in 1998, and Chief Resident in Neurosurgery at the University of Washington in 2000. Dr. Ghatan completed his fellowship in Pediatric Neurosurgery at Seattle Children's Hospital in 2001, and was awarded the Van Wagenen Fellowship from the American Association of Neurological Surgeons in 2002. He completed a research fellowship in neural development at Great Ormond Street Hospital in London in 2002 before coming to New York and Columbia Presbyterian.

Dr. Ghatan specializes in Pediatric Neurosurgery, with special emphasis in epilepsy surgery and the treatment of a wide range of neurosurgical conditions including brain and spinal cord tumors, minimally invasive treatments of tumors, hydrocephalus, and arachnoid cysts, and spinal disorders. He has won numerous

*"Dr. Ghatan changed everything for me. I have a new life."*

### Patient Profile

#### Erica R.

At two years-old, Erica got her first migraine. Her parents said she just kept crying and tapping her chubby little fingers against her head.

These migraines got worse over the years and by twelve years old, a spinal tap confirmed she suffered from a pseudo tumor. At 17 she finally had a shunt put in to relieve the pressure in her head. This allowed her to graduate from high school and go off to college.

Just 24 hours at her new school, however, Erica got one of her worst migraines yet. It turned out the shunt had broken. Over the next few years Erica would have to undergo seven shunt replacements.

The last shunt failed at the end of her junior year in college. This was when she finally met Dr. Saadi Ghatan and she was able to have the ICE surgery.

The surgery was a huge success. Erica completed her final year at college and was accepted into graduate school at Columbia University. "A dream," she says, "I didn't think was possible because of my medical problems."

Since her surgery, Erica has also been able to travel. She says, "I just got back from Machu Picchu. Before, I couldn't go anywhere. There were times my mom had to help me to the shower."

Erica says she also discovered that she loves to dance. "I had never danced before in my life. I couldn't. Now I take three dance classes a week and I have even performed."

Last month, Erica graduated with her Masters Degree in Social Work from Columbia. She has started her first job as a hospice social worker, and she loves it.

awards for his research work, including the Van Wagenen Fellowship from the AANS, the Elsberg Fellowship from the New York Academy of Medicine, and the Florence Irving Fellowship at Columbia University. Dr. Ghatan has an active research effort in pediatric epilepsy surgery, in collaboration with colleagues in Pediatric Neurology, Dr. Steve Wolf and Patty McGoldrick at Beth Israel Medical Center. He is the author of numerous peer reviewed publications in Neurosurgery and Neuroscience, and a Pediatric Neurosurgery Section Editor of the latest edition of Youman's Textbook of Neurosurgery.

## Internal Cranial Expansion Procedure (cont.)

of the brain cavity. This makes more room for the brain and CSF and the pressure is relieved.

The procedure itself can be long and quite involved, however. Surgeons perform a zig zag incision on the top of the head. They carefully peel back skin and muscle to reveal the bone. Then they remove four large window-pane like squares of bone leaving cross struts in place. The underside, or inner table, of the bone flaps are then removed to thin them. Some of the bone on the underside of the struts left on the skull is also removed. All of this can be done with one surgical team but in the interest of decreasing operation time the surgical teams at the Pediatric Neurosurgery Center recommend two.

Then, using titanium plates and screws the squares of bone are put back in place. The skin and muscles are then repaired and the patient is monitored closely throughout recovery. It is important to note that throughout the entire procedure, surgeons never have to delve into the delicate structure of the brain itself.

The surgeons at the Pediatric Neurosurgery Center have had great success with this procedure. One study they did showed that in a group of children with IIH who had this procedure, there was, "Resolution of papilledema within 4 weeks, normalization of Intracranial Pressure (ICP) in all patients, resolution of headaches in four out of five patients, and successful removal of shunts in all patients."

Based on their experience with this population, they have concluded that, "Internal Cranial Expansion provides lasting normalization of ICP, visual symptoms and papilledema, without the need for shunting."

Overall, ICE is a particularly good option for patients who have had chronic shunt failures and/or infection, still have high pressure and no relief of symptoms even with properly working shunts, or for those patients with severe and rapidly increasing headaches or visual problems.

*ve a normal life now."*





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The Division of Pediatric Neurosurgery at Columbia University Medical Center and the Morgan Stanley Children's Hospital of NewYork-Presbyterian, one of the largest in the Northeast, offers comprehensive services for all children with neurosurgical issues. With three full-time board certified pediatric neurosurgeons practicing at the highest ranked Children's Hospital in the Tri-state area, the Division provides a broad range of expertise in an unparalleled, supportive environment. Clinical problems including hydrocephalus, brain and spinal tumors, Chiari malformation, craniosynostosis, tethered cord, complex spinal deformity, spasticity, epilepsy, arteriovenous malformations (AVMs), Moya-moya, and many other disorders are treated with the most effective methods available.

Patients can be seen at nine convenient locations throughout the Tri-state area. For an appointment with one of our pediatric neurosurgeons, call any of the numbers listed on this page.

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