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Radiological Case of the Month

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A 9-YEAR-OLD GIRL presented with a 5-day history of a mild frontal headache. She had undergone a craniotomy 1 year earlier for a right frontal and intraventricular low-grade astrocytoma. At surgery, a right ventricular shunt was placed for hydrocephalus. Two months postoperatively, the shunt-dependent child required shunt revision for a loculated right lateral ventricle. The patient was receiving no medications, had no recent history of trauma, and was doing well in school.

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A follow-up magnetic resonance imaging (MRI) scan was obtained 2 weeks prior to presentation and demonstrated stable ventricular size. The study was degraded by a magnetic susceptibility artifact. Findings from physical examination were unremarkable. The patient was afebrile, vital signs were stable, and she was neurologically normal. The surgical incisions were well healed, and shunt tubing was palpable subcutaneously along the right lateral aspect of the neck; the right parietal shunt reservoir pumped and filled well.

Radiographs of the head and neck were obtained to evaluate the shunt and better define any surgical hardware that might have affected the MRI (**Figure 1** and **Figure 2**). Radiographs were interpreted as showing discontinuity of the shunt at 2 locations. The child was referred to a neurosurgeon for evaluation of headache believed to be related to shunt disconnection or malfunction.



Figure 1.



Figure 2.

Denouement and Discussion

Nasal Foreign Body Simulating Headache From Shunt Malfunction

Figure 1. Lateral skull radiograph shows 2 proximal shunt tips in the region of the lateral ventricle, one placed from a frontal location, the other from a parietal location. (The proximal end of a shunt shows multiple small perforations visualized on a radiograph.) These are connected at the location where a radiolucent reservoir and valve join. This valve connects to the distal tubing at a temporal location. Craniotomy closure hardware is present at 3 superficial locations. No shunt disconnection is seen. A circular metal foreign body is noted in the region of the nose.

Figure 2. Anterior-posterior skull radiograph shows 2 proximal shunt tips in the region of the right lateral ventricle with tubing coursing down the right side of the skull and neck. (Note the distance between the parietal proximal shunt tip and the superficially located distal tubing, which was confused with a disconnection in Figure 1.) The craniotomy closure hardware is present. A button-shaped metallic foreign body is present overlying the face.

The child was referred to a pediatric otolaryngologist who removed a metallic button from her right nasal passage. Presumably, it was in place for more than 2 weeks before MRI. The nasal mucosa overlying the inferior turbinate was eroded; there was no nasal discharge. An oral antibiotic was prescribed for 1 week to treat the localized mucosal infection and sinusitis prophylaxis. Her headache completely resolved.

The history tells us that this patient's hydrocephalus had been complicated by a loculated right ventricle treated 2 months after the initial shunt placement. Loculated ventricles usually occur after an inflammatory process, but excessive cerebrospinal fluid drainage by itself may result in loculation of the ventricular system. This loculation is usually a fourth ventricle entrapment but has occurred in the lateral ventricles. Loculation of the ventricular system may require multiple drainage systems for treatment. To prevent pressure gradients between "trapped" areas in the ventricular system, it is advisable to connect several proximal catheters to the same valve system instead of using separate shunt systems.^{1(p149)} Knowledge of the configurations of shunt hardware is important for accurate imaging interpretation.

Another important facet in radiologic evaluation of a hydrocephalic child is the physical and mechanical traits of an implanted medical device. Shunt construction material is usually silicone rubber impregnated with barium or tantalum to produce radiopacity.^{1(pp42-44)} In this case the implanted multipurpose, medium-pressure, on-off valve had no additive to the silicone, and, except for the small, on-off switch, was radiolucent.

Few materials are currently implanted during neurosurgery that are incompatible with MRI or that seriously degrade the MRI signal. Stainless steel has been replaced with titanium—a nonferrous, nonmagnetic metal. Titanium has proven to provide strength and biocompatibility and is suitable for all postoperative imaging techniques.²⁻⁴ A postoperative MRI showing a metallic artifact should raise questions about metallic foreign bodies unrelated to closure hardware or indwelling clips.

Nasal foreign bodies that require removal occur commonly in the pediatric population. Beads, small toys, paper wads, and food can be removed successfully

with simple equipment. Typical initial symptoms include local discomfort, nasal obstruction, and sneezing, and later mucosal irritation or infection with purulent or bloody nasal discharge. Complications such as ingestion or epistaxis may be related to unskilled attempts at removal.^{5,6}

Pediatricians are the first line of intervention in suspected shunt dysfunction cases for their ability to evaluate the hydrocephalic child and recognize shunt malfunctions. It is important to differentiate common childhood ailments (eg, headache, nausea, vomiting) as related or unrelated to shunt malfunction. The initial interpretation of these radiographs did not match findings from clinical examination (reservoir was palpable on examination but not seen on radiograph) or clinical history (Y-type shunt placement for loculated ventricle but not indicated in radiographic report). In an era of MRI, one would not expect a magnetic susceptibility artifact on an MRI from craniotomy hardware. Although the child presented with a frontal headache, this symptom did not progress to other signs of shunt malfunction, which characteristic is unusual in a shunt-dependent child with shunt disconnection.

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Submissions

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