Fluoroscopy of programmable cerebrospinal fluid shunt valve settings

Technical illustration

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Plain x-ray films have been suggested as a way to visualize the valve assembly and pressure setting of the Codman–Medos programmable valve (Johnson & Johnson Professional, Inc., Raynham, MA) (Fig. 1). However, the pressure setting can be read accurately only if the x-ray film is obtained within 30˚ orthogonal to the circular motor (BA Kaufman, unpublished data).

The use of fluoroscopy rather than radiography to evaluate this externally programmable cerebrospinal fluid shunt valve has resulted in a significant savings in time and effort for patients and physicians. The patient is positioned to approximate a lateral view of the valve, and fluoroscopy (magnification factor 11:7, 73 kV, 6.1 mA, 24 in focal spot to skin [Fluorospot H; Siemens, Iselin, NJ]) quickly localizes the device. The patient is rotated as needed to obtain an orthogonal view of the valve. A digital image may be captured and printed for documentation, eliminating the need for a spot radiograph with its radiation dose (Fig. 2). Using fluoroscopy, the reprogramming unit is placed more accurately over the valve, and reprogramming can be accomplished with one attempt. The entire study is accomplished in minutes and the images are consistently readable. The charges to the patient are the same as for plain radiographs because of the more efficient utilization of equipment and personnel.

Prior to development of this technique, patients required two to five plain x-ray films and as much as 1 hour in the radiology department. Because the radiologist was not aware of the valve location, the placement of the valve usually precluded obtaining orthogonal views with a standard skull film, and small infants would move between attempts to obtain appropriate images. Neurosurgeons were frequently needed to position the patient and to evaluate the images.

The total time needed for fluoroscopic documentation of valve settings has been reduced to less than 5 seconds, and patients spend less than 10 minutes in the radiology department. Neurosurgical assistance is rarely needed, although the neurosurgeon should still review and confirm the setting. The reprogramming time has also been reduced, with the neurosurgeon called when the patient goes into the fluoroscopy suite.

The short fluoroscopy time results in a significantly reduced radiation dose compared to multiple cut films. The radiation dose for fluoroscopy is 49 mR/second (magnification 11:7, 73 kV, 6.1 mA, 24-in spot–skin distance), compared to a cut film radiography dose of 290 mR/film (lateral view, 63 kV, 32 mA, 30-in spot–skin distance). Thus, the radiation dose for a single cut film radiograph approximates 6 seconds of fluoroscopy time.

Disclosure

The authors have no financial interest in the cerebrospinal fluid shunt valve or the radiographic technique discussed in this report.