## ON-LINE APPENDIX

### *Possible Clinical Applications Using Time-SLIP to Visualize and Monitor CSF Movement*

#### Hydrocephalus

- Stenosis of the aqueduct
- Obstruction at the foramina of Monro
- Outlets of fourth ventricle
- Within the ventricular system (multiloculated)
- To define CSF drainage pathways and physiologic factors that may alter drainage routes: superior sagittal sinus and basal cisterns/nerve sheaths.

#### Normal Pressure Hydrocephalus

- CSF flow through the aqueduct
- Candidate for ETV
- To better determine which patients would benefit from shunting.

#### Third Ventriculostomy (ETV)

- Preoperative evaluation of CSF flow through the aqueduct and basal cisterns
- Success of ETV
- Follow-up of patency of the ostium
- A subset of patients with hydrocephalus secondary to repaired open neural tube defects (myelomeningocele) who might be candidates for ETV.

#### Ventriculostomies

- Placed for subarachnoid hemorrhage, trauma, tumors, and infection
- To help determine which patients will require a shunt.

#### Low or Negative Pressure Hydrocephalus

- Need to drain CSF at zero or a negative pressure; otherwise ventricles enlarge and the patient becomes more symptomatic
- Need to decrease the size of ventricles
- To determine whether negative pressure hydrocephalus is related to a change in compliance.

#### CSF Leaks

- Difficult to pinpoint the site of the leak
- Sometimes uncertain whether CSF leak is present.

#### Arachnoid Cysts

- Why do they enlarge?
- Presence of a ball-valve mechanism
- Widened subarachnoid space over the tip of the temporal lobe or an arachnoid cyst?
- To determine communication with subarachnoid space
- Large cisterna magna or cyst
- To monitor the success of fenestration
- Why, with what appears to be a good fenestration at the time of surgery, one still needs to place a shunt.

#### Tumor Cysts

- Loculated.

#### Colloid Cysts

- Degree of obstruction
- Movable.

#### Pseudotumor Cerebri (Benign Intracranial Hypertension)

- CSF problem
- Venous drainage problem
- Other factors
- Multiple causes with various substrates
- Effect of optic nerve fenestration.

#### Shunts

- To visualize CSF flow within a shunt
- To detect shunt malfunction
- Overdrainage.

#### Chiari I

- To observe CSF flow anterior/posterior to the spinal cord
- To relate to symptoms such as headache
- To relate to syrinx formation
- Postoperative success, especially as to syrinx size
- Movement of CSF in a syrinx and the relation to change in size
- To determine whether CSF movement at the craniocervical junction subsequently becomes impaired
- Function of syringopleural/peritoneal shunt.

#### Spinal Arachnoid Cysts

- Diagnosis
- Success of fenestration.

#### CSF Movement in Relation to the Position of the Patient

- With few exceptions, can only image horizontally
- To see what changes occur: sitting, standing, and head down.