

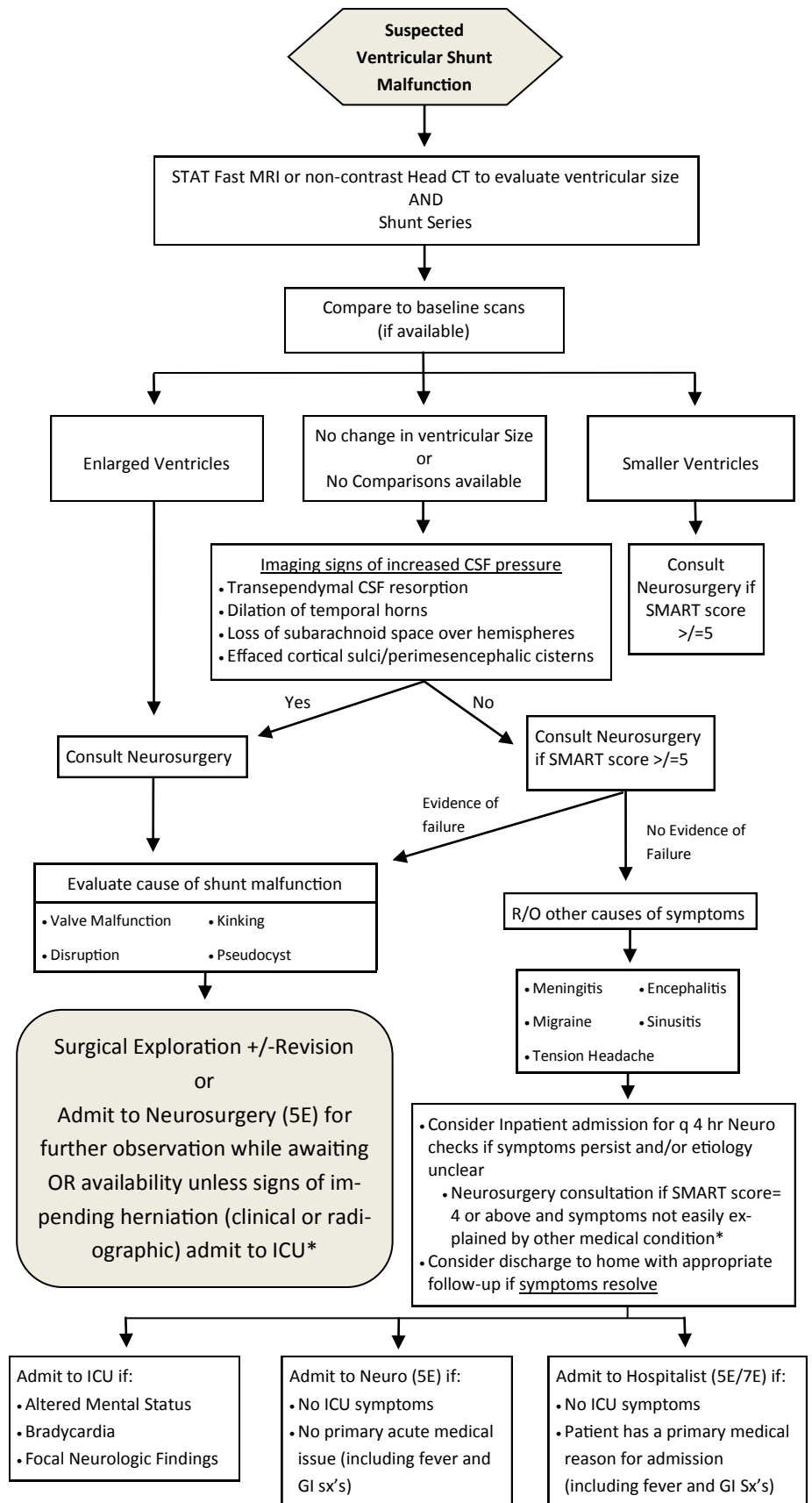
Ventricular Shunt Malfunction Diagnostic Algorithm

Acute Symptoms		
• Nausea	• Headache	• Irritability
• Vomiting	• Positional Headache	• Lethargy
• Hypertension	• Double Vision	• Stupor
• Bradycardia	• Sundown Sign	• Coma
• Seizures	• Transient visual obscurations (e.g. visual blackouts)	

Subacute/Chronic Symptoms	
• Change in behavior (e.g. agitation)	• Developmental regression
• Altered gate	• Change in cognitive function (e.g. attention span)
• Change in feeding patterns	• Daily headaches
• Change in school performance	• Increased head size

History to be Obtained Prior to Neurosurgical Consult
• Prior history of shunt failure
• Size of ventricles at last shunt failure
• Prior history of shunt failure without change in ventricular size
• Presence or absence of fevers
• Presence or absence of above acute and chronic symptoms

Fast MRI vs Head CT	
• Available weekdays 8 am– 10 pm and weekends 8 am – 4 pm • Patient must be able to lie still/cooperate for 10 minutes without sedation (roughly age $\geq$ 5 yrs)	
Contraindications to Fast MRI	
• History of trauma • r/o hemorrhage or pneumocephalus • Programmable VP shunts • Unable to obtain within 1 hour of presentation	• Altered mental status • If shunt catheter needs to be visualized • Patients with other MRI contraindication (ex–pacemaker)



*Neurosurgical Attending notification at time of admission is expected

SMART SCORE

(SHUNT MALFUNCTION ASSESSMENT AND REASSESSMENT TOOL)

Inclusion Criteria: Patient with VA or VP shunt and age > 1 month

Exclusion Criteria: Patients in the NICU

Major Criteria: (10 points each)

- * Clinical signs of herniation (including Cushing's Triad)
- * Imaging with signs of herniation/impending herniation
- * Papilledema

Minor Criteria:

Tier 1 (5 points each)

- * Positional headache (include awakening from sleep due to headache pain)
- * New diplopia/CN VI palsy
- * Altered MS (e.g. irritability, lethargy) in a patient w/ no (or mild) prior neurological deficit
- * Neuroimaging with increased size of ventricles and/or decrease in sulci and/or cisterns (more sensitive if baseline large ventricles)
- * History of VP shunt failure without prior change in ventricular size
- * Head circumference increasing across percentiles (e.g. > 10%)

Tier 2 (2 points each)

- * Nausea/vomiting
- * Headache
- * Bradycardia (not baseline)
- * Increased seizure frequency from baseline
- * Recent manipulation of VP shunt (e.g. change of setting of valve, revision in the last 30 days)
- * Change in baseline in a patient with moderate to severe baseline deficits
- * Neuroimaging with inc size of ventricles and no change in sulci and/or cisterns
- * Radiographic evidence of shunt tubing disconnection

Recommended response based on assigned score

10 = immediate response from neurosurgery attending

5 -9 = high suspicion for shunt malfunction, neurosurgical consult. If no intervention prescribed, consider escalation to neurosurgical attending.

4 = moderate suspicion for shunt malfunction. Observation recommended. If symptoms not easily explained by other medical condition, consult neurosurgery.

** If score remains ≥ 4 consider repeat imaging Q2-3 days and/or ophthalmology evaluation for papilledema, even if other explanations plausible for observed symptoms.