I. History

Triad symptom	Queries	NPH characteristic
Gait and falls	Onset, course, type Assistive devices used, how long Circumstances surrounding falls Syncope Orthostatic hypotension Arrhythmias Seizure Orthopedic Rheumatologic	Wide base Feet externally rotated Difficulty initiating step "Magnetic" Freezing unresponsive to visual cue Reduced stride, shuffle Posture upright or flexed
Urinary Symptoms **Consider urology referral**	UMN vs. local pathology Urgency/frequency Retention Reduced stream Leakage, especially with valsalva Delay or confusion in reaching the bathroom	Urinary urgency Frequency
Cognitive symptoms	**Consider AD (may be comorbid)** ○ unintentional repetition of questions or comments ○ navigational troubles while driving ○ dominant word retrieval difficulties with paraphasias, ○ simple delusions (theft, infidelity), paranoia ○ weight loss **Consider FTD** ○ stereotypic speech and nonfluency ○ stuttering, echolalia, palilalia ○ socially inappropriate comments and behavior ○ impulsive behavior, rituals and compulsions (esp. food rituals) ○ marked apathy, lack of intitiative ○ loss of empathy ○ hyperphagia, weight gain **Consider DLB** ○ dominant word retrieval difficulties <u>without</u> paraphasias ○ car crashes, trouble using appliances/machinery early ○ complex delusions, infidelity visual hallucinations(early), doubles, imposter, phantom boarder, TV or mirror image real ○ REM sleep behavior disorder ○ dysautonomia ○ longstanding anosmia	Retrieval deficit in memory Executive dysfunction Visual-spatial difficulties

Consider co-morbid and predisposing conditions	
Sleep apnea	Sleep referral and treat. Re-evaluate when stable
Congenital hydrocephalus: head circumference **Males >59cm** **Females >57.5cm**	Hydrocephalus with decompensation No further work-up needed. Refer for shunt
Secondary hydrocephalus (previous intracranial bleeding, head trauma, meningitis, encephalitis, previous neurosurgical procedure)	Hydrocephalus. No further work-up needed. Refer for shunt
Cervical myelopathy	MRI C-spine on everyone. May need cervical decompression before shunt
Delirium, recent illness or hospitalization, UTI	Await recovery and recheck in 4 weeks
Autonomic dysfunction	Orthostatic hypotension, arrhythmia, syncope Dry eyes, dry mouth, altered sweat Cold/heat intolerance, constipation, incontinence Loss of smell/taste

Medication issues	
Anticholinergics (Modified Beer's List, Appendix A) **Antidopaminergics, sedatives, anti-epileptics**	Minimize or switch to one with less cognitive or parkinsonian side effects Refer back to prescribing physician for alternative
Acetylcholinesterase inhibitors, memantine, Parkinson's medications, anti-depressants	Stable dose for 30 days before work-up. Note that patients with hydrocephalus may be partially levodopa responsive.
Anticoagulants	Surgery precluded if indication for anticoagulant is for artificial valve, recent PE/DVT, other causes
Active alcoholism or drug abuse	Stable sobriety or abstinence required

II. Physical exam

Focused exam and differential	
Mental status	MoCA as baseline. (Optional) May have retrieval deficit in memory, executive and visuo-spatial dysfunction Amnestic disorder, fluent and nonflulent aphasia, suggest alternative diagnoses
Affect	May have hypomimia, hypophonia, reduced spontaneous gesture Moria, euphoria, disinhibition, pseudobulbar (IEED) suggest alternative diagnoses
Extraocular movements	May have diminished upgaze Downward vertical gaze palsy, progressive external ophthalmoplegia, nystagmus suggest alternative diagnoses
Strength	Lower extremity strength, tone, and function normal if seated or supine Myelopathy, peripheral neuropathy, or hemiparesis suggests alternative diagnoses
Tremor	May be present in NPH, often less prominent
Gait	Wide base, feet externally rotated, difficulty initiating step, freezing unresponsive to visual cues, festination, reduced stride, shuffling, posture upright or flexed, arm swing maintained or reduced with flexed posture. May be nonambulatory if advanced NPH Assess ability to stand from a seated position with arms crossed. Note number of attempts and/or need for upper body support. Note base, rate, speed, posture, arm and head swing. Note extra steps on turns, festination, difficulty in doorways, response to visual cues with freezing Romberg's. Tandem. Pull test. Narrow base, absent ataxia, ataxia without apraxia, sensory ataxia suggests alternative diagnoses.
Reflexes	May have hyper-reflexia, clonus, and extensor plantars
Orthostatics	Presence of orthostatic hypotension suggests alternative diagnosis. Evaluate medications. Consider dysautonomia of DLB, peripheral neuropathy, paraneoplastic disorders
Rheumatologic	Gout,foot disorders, ulcers, knee and hip joint deformities, Kyphosis, scoliosis, flexed forward at waist from lumbar spinal stenosis
Head circumference **Cervical ROM**	Head circumference (Male>59cm, female>57.5cm) suggests obstructive hydrocephalus Limitation in cervical ROM, Lhermitte's sign suggest alternative diagnoses

III. Objective tests

Standard testing	
MRI brain ***dementia protocol***	Evan's ratio, transependymal flow Asymmetric ventricular enlargement relative to the 4th (aqueductal stenosis) Chiari malformation (hydrocephalus) Degree of atrophy, regional atrophy, micro/macrovascular disease (other dx) Cerebellum or basal ganglia signal change (other dx)
MRI C-spine	Check for compressive myelopathy; may need cervical decompression first
B12, folate, TSH, RPR	Treat deficiencies first
Urinalysis with C/S	Treat infection and re-evaluate
Urine toxicology	Consider role of drugs if positive screen
Vitamin D	Treat deficiency. Continue NPH work-up.
HgbA1C	Attempt strict control of diabetes
CBC **biochemistry profile including ionized and total Ca++**	Rule out anemia, electrolyte abnormalities and hyperparathyroidism
PT/PTT	Needed before LP

IV. NPH tests

Assessment and Plan	
Identify and treat other problems contributing to gait, cognition, and bladder difficulties **If NPH is still a consideration, continue with steps below.** When in doubt, continue with NPH evaluation	
Contact Terry Czaplicki, RN **NPH nurse coordinator (for all steps below)**	248-325-3095, TCzapli1@hfhs.org
Tests performed by NPH team **(All done at W. Bloomfield)**	Modified CERAD battery, Trails A and B MoCA (if not done in the last 30 days) PSP scale (upper extremity and fine motor skills) Neuropsychiatric Inventory (NPI) with caregiver scale Epworth sleepiness scale Urinary incontinence impact scale High volume LP with removal 30-50cc CSF CSF analysis (routine neurology tests) Tau/A-beta recommended; family decides Gaitrite before and after LP Phone call 24h after LP to assess family's informal appraisal of any change in gait, cognition, or bladder
NPH conference	1-3 weeks after LP (to allow for tau/A-beta results) Wednesdays from 4-5pm Videoteleconferencing : Neurosurgery library Main Campus 313-916-4290 Neurology conference room W. Bloomfield 248-325-2160 Telephone conferencing available from any other location. Call in #: 866-809-1451 Passcode: 2739829 Notify Terry Czaplicki if you wish to participate. Your patient will be discussed at your convenience Results and recommendations summarized in Epic
Recommendations	Patients and family directed to referring physician for discussion of results If desired, NPH team member will meet with patient and family for discussion of results
Referrals for shunting/ETV	Referrals will be directed to treating neurosurgeon, Jason Schwalb, MD, or Ellen Air, MD
Request for lumbar drainage trial	In complicated cases or if results from high volume LP are equivocal, an inpatient continuous lumbar drainage trial may be requested. The patient will be referred to the admitting neurosurgeon as an outpatient. Terry Czaplicki will coordinate the admission to the Neuro ICU with neurosurgery nurses

	Results will be shared in the next NPH conference Notify Terry Czaplicki if you wish to participate in the NPH conference discussion
Post shunt/ETV follow-up	Monthly neurosurgery visits and imaging as indicated Comprehensive reassessment once stable Modified CERAD, Trails A and B, MoCA PSP scale NPI with caregiver distress scale Epworth sleepiness scale Urinary incontinence impact scale Gaitrite Neuro exam Medication review
Long term re-evaluation	Annual reassessment recommended through NPH clinic Contact Terry Czaplicki to arrange visit Test battery as above
Acute change in function	Check for medical illness, UTI, OTC or prescription drug side effects CT head for hemorrhage If MRI performed, notify Sally Goldman to arrange for resetting of shunt valve after MRI If no etiology identified, refer to Dr. Schwalb or treating neurosurgeon for evaluation of shunt patency and function