



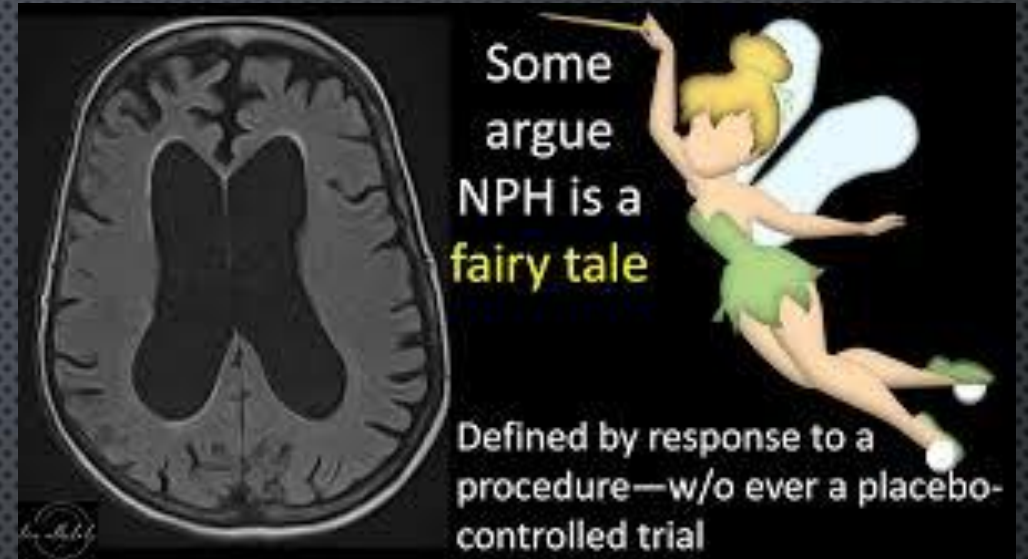
NORMAL PRESSURE HYDROCEPHALUS: A TREATABLE DEMENTIA

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NPH



- TRIAD OF GAIT DISTURBANCE, COGNITIVE IMPAIRMENT AND URINARY INCONTINENCE
- DIAGNOSIS TRICKY, NORMAL AGING, PARKINSON'S, ALZHEIMER'S
- TREATMENT WITH SHUNT

PENS

CLINICAL TRIAL: THE PLACEBO-CONTROLLED EFFICACY OF INPH SHUNTING (PENS) TRIAL

- NIH FUNDED STUDY
- PATIENTS WHO RESPOND TO TAP TEST GET SHUNTED
- SHUNTED STUDY PATIENTS WERE THEN RANDOMIZED TO SHUNT OFF OR SHUNT ON
- OUTCOME IS GAIT AT 90 DAYS

WHY TREAT NPH?

- VERY GRATIFYING
- INCREASING PREVALENCE WITH AGING POPULATION
- COST TO SOCIETY

NORMAL BRAIN FLUID: ORTHODOX VIEW

- CALLED CEREBROSPINAL FLUID (**CSF**)
- PRODUCED IN THE VENTRICLE BY SPECIALIZED CELLS CALLED THE **CHOROID PLEXUS**
- CIRCULATES DOWN AROUND THE SPINE (SAMPLED WITH SPINAL TAP, A.K.A. LUMBAR PUNCTURE)
- ABSORBED BACK INTO BLOOD VIA A BIG VEIN IN THE CENTER OF THE HEAD (SUPERIOR SAGITTAL SINUS)
- DRAINS THROUGH SPECIAL CELLS CALLED **ARACHNOID GRANULATIONS**

Review of Cerebrospinal Fluid Physiology and Dynamics: A Call for Medical Education Reform

Neurosurgery 91:1-7, 2022

SURGERY FOR NPH: SELECTION

- CLINICAL TRIAD AT LEAST IN PART
- POSITIVE LP OR LUMBAR DRAIN
- ELEVATED TAU PROTEIN OKAY IF CLINICAL IMPROVEMENT WITH CSF REMOVAL
- IF LP IS POSITIVE, SHUNTING RESULTS IN IMPROVEMENT IN NEARLY EVERY SHUNT PATIENT
- WHAT IS THE FALSE NEGATIVE RATE????

VENTRICULAR VERSUS LUMBAR SHUNTING

- LUMBAR SHUNT HAS THE APPEAL YOU DON'T HAVE TO CANNULATE THE BRAIN
- MANY STUDIES SHOW IT WORKS BUT FAILURE RATES MAY BE HIGHER THAN VENTRICULAR
- LUMBAR SHUNT MAY BE A VIABLE ALTERNATIVE BUT VENTRICULAR SHUNT IS MOST COMMON

VENTRICULAR PERITONEAL SHUNTING

- MOST COMMON
- FAMILIAR TO MOST NEUROSURGEONS
- SINCE IT IS A LOW PRESSURE PATHOLOGY IS ABDOMINAL PRESSURE TOO HIGH?

VENTRICULO-ATRIAL

- POPULARITY HAS FALLEN AS POTENTIAL FOR SERIOUS COMPLICATIONS HIGHER THEN PERITONEAL
- NEVERTHELESS IS RELATIVELY EASY TO LEARN AND MINIMIZE RISK
- DOES THIS REDUCE SHUNT FAILURE FROM HIGH INTRA-ABDOMINAL PRESSURE?
- DOES THE ACTUAL RISKS REALLY HIGHER?

VENTRICULO-PLUERAL SHUNT

- LIKE ATRIAL IS NOT AS FAMILIAR AS PERITONEAL SHUNTING
- LIKE ATRIAL MAY BE GOOD ALTERNATIVE IF ABDOMEN HOSTILE
- LIKE ATRIAL AT LEAST POTENTIAL COMPLICATIONS HIGHER

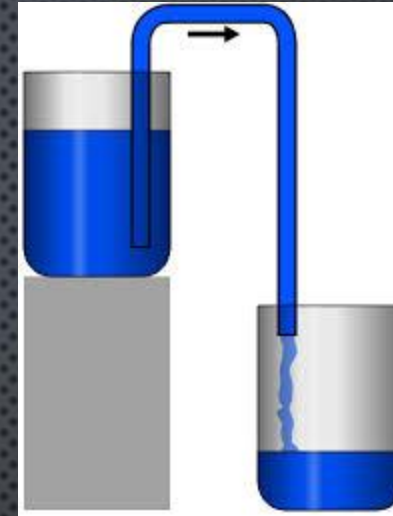
VALVES: PRESSURE DIFFERENTIAL

- FIXED VALVE----CAN USE MEDIUM OR LOW PRESSURE
- PROGRAMMABLE VALVES---- MORE CONTROL? ,COMPENSATE FOR LATER DECLINE?
 - NEED INFRASTRUCTURE TO FOLLOW THESE
- PROGRAMMABLE, PRESSURE DIFFERENTIAL MOST COMMONLY USED

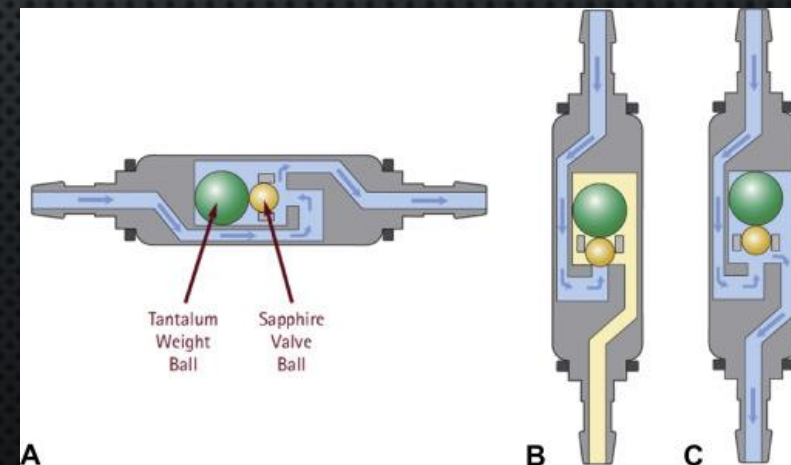
VALVES: FLOW REGULATED

- ALLOWS A FIXED VOLUME OF CSF TO BE REMOVED REGARDLESS OF PRESSURE
- LOW FLOW MAY BE ALL YOU NEED
- FEW STUDIES COMPARING VALVES
- LOWER cSDH?
- NO NEED TO PROGRAM BUT NOT OPTION TO PROGRAM

ANTISYPHON?



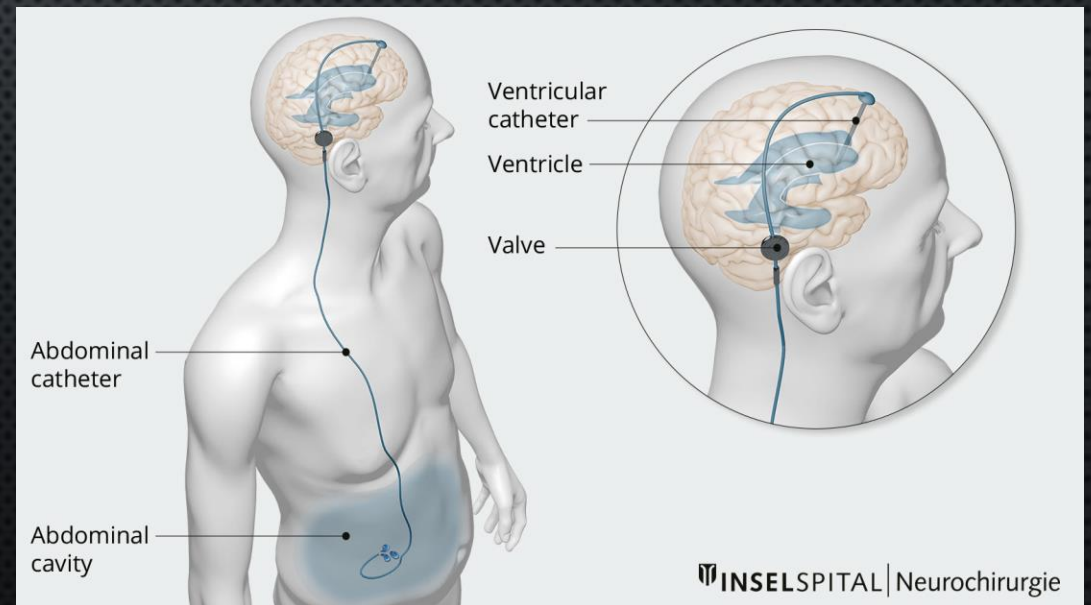
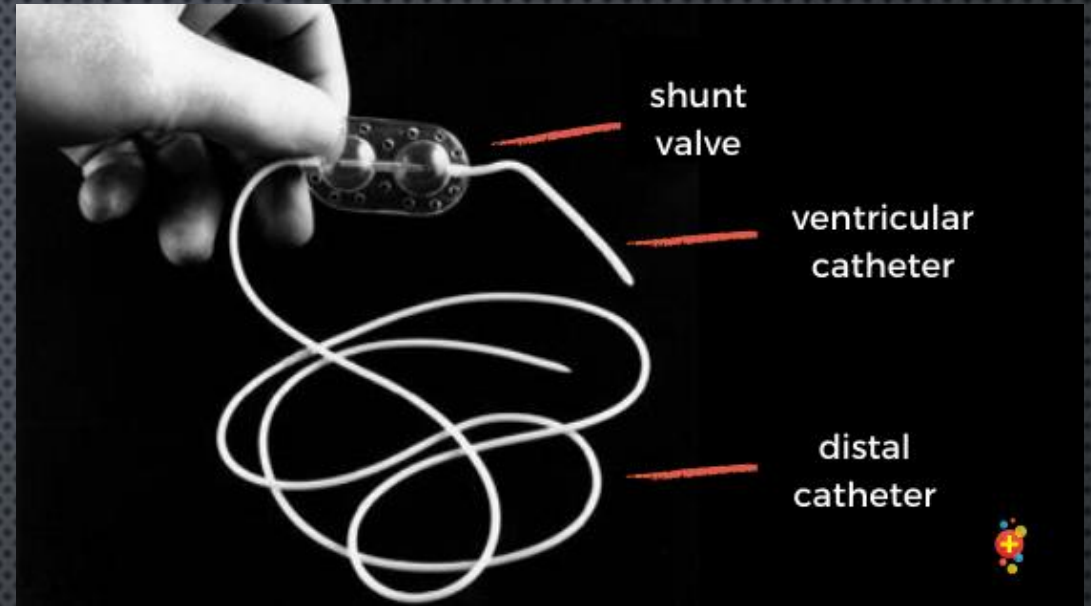
- OPTION TO PLACE
- MAY REDUCE CSDH RATE BY MINIMIZING GRAVITY'S EFFECT ON FLOW
- PROVIDES FOR VIRTUAL OFF
- MAY REDUCE CLINICAL EFFICACY



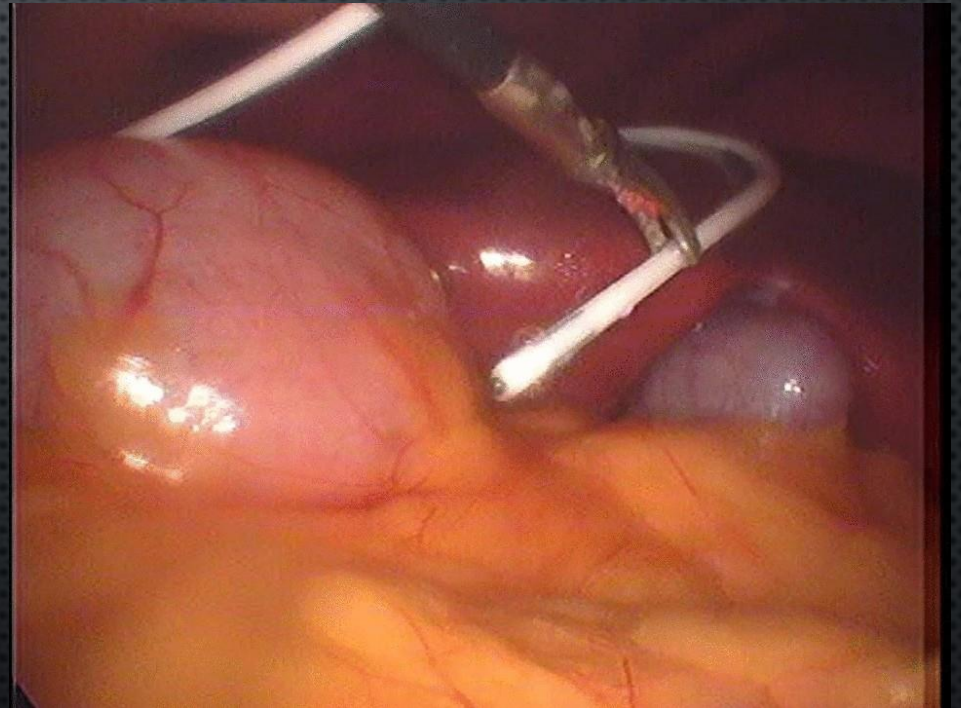
SHUNT SURGERY

- TAKES ABOUT AN HOUR
- ABOUT A 1% RISK (INFECTION, ASYMPTOMATIC TRACT HEMORRHAGE)
- HOSPITAL STAY IS TYPICALLY ONE NIGHT
- RECOVERY IN ABOUT 10 DAYS
- IMPROVEMENT BY ONE MONTH

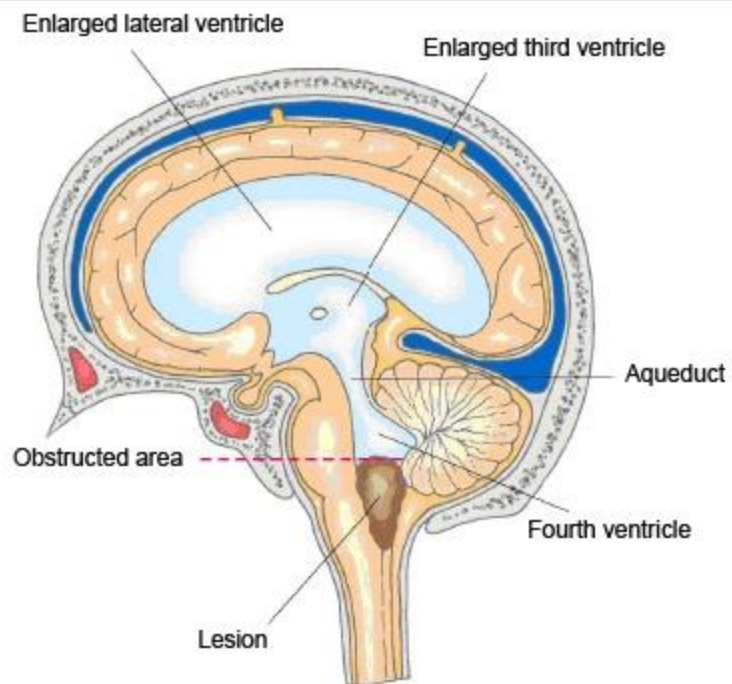
SURGERY



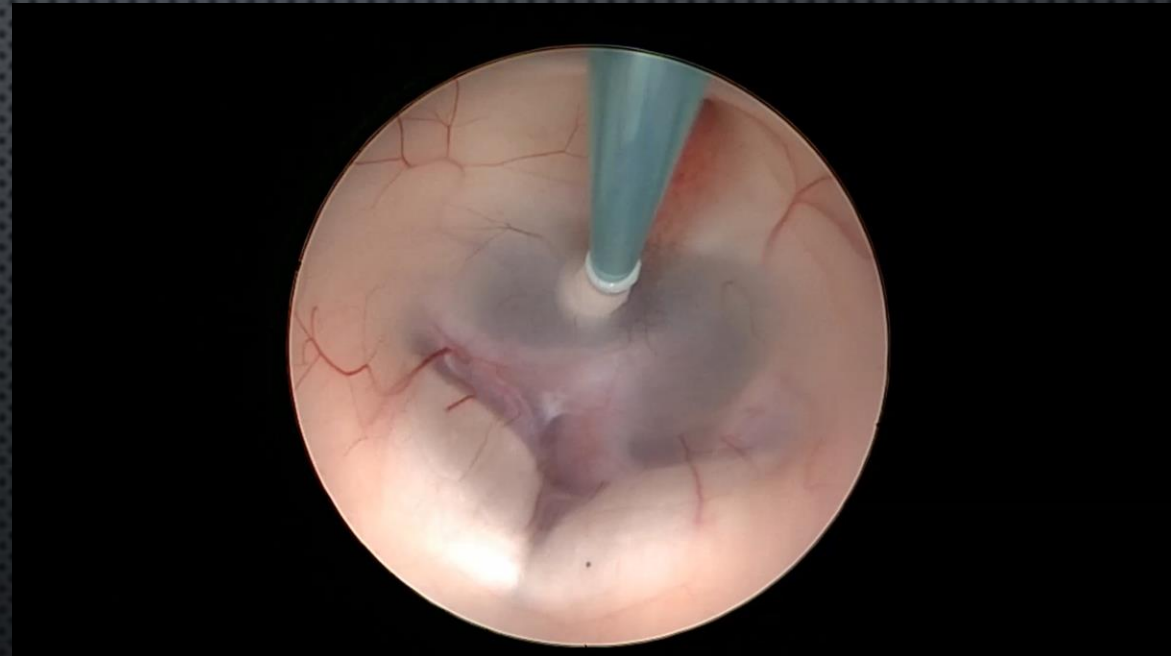
SURGERY: ABDOMEN



THIRD VENTRICULOSTOMY



Source: M Matsumae. Understanding the tumor. Clinical study. Vol 29, No. 14, 2008. Medical Friend Co. Ltd. Illustrator Kitahara Isao



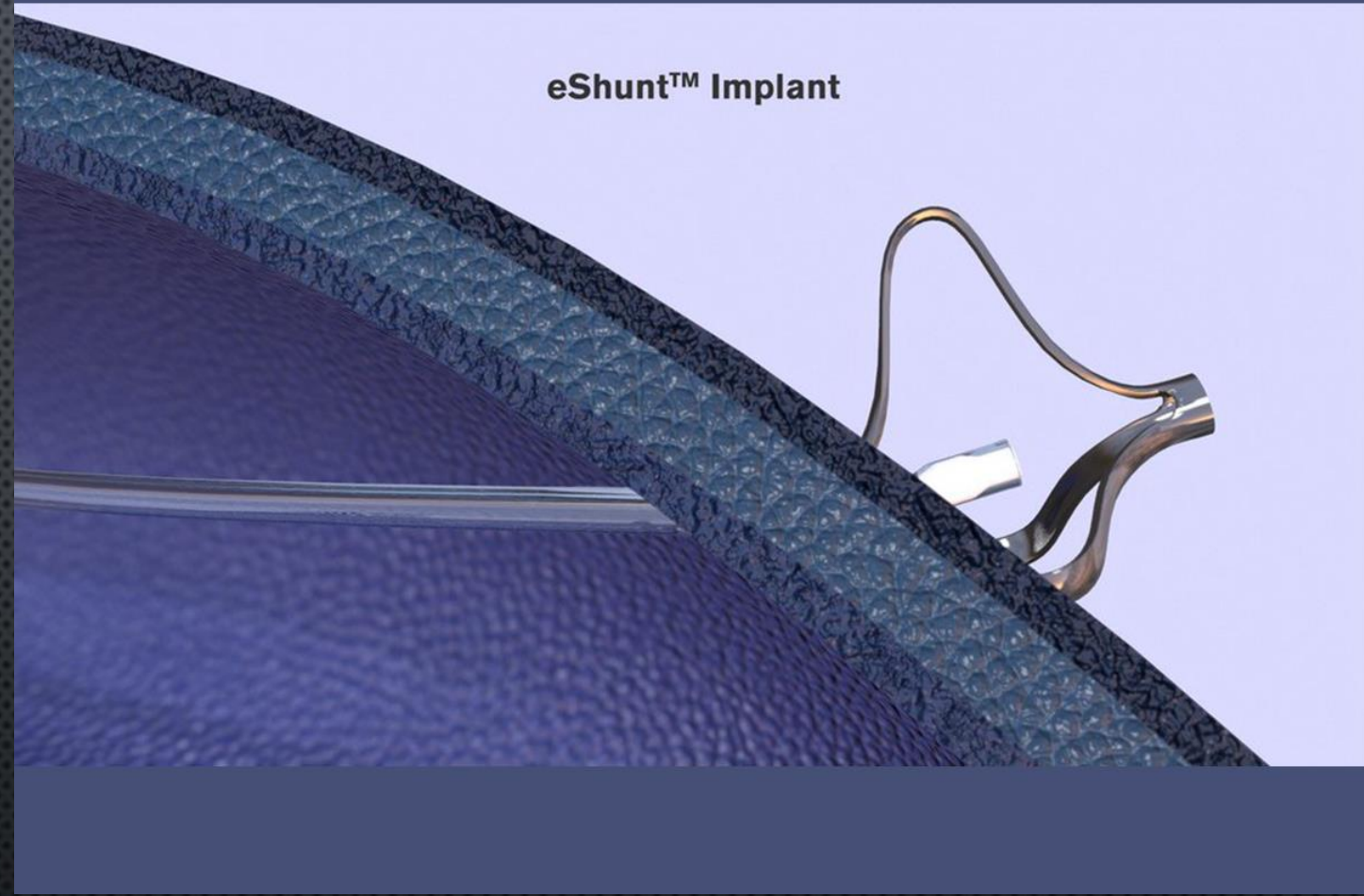
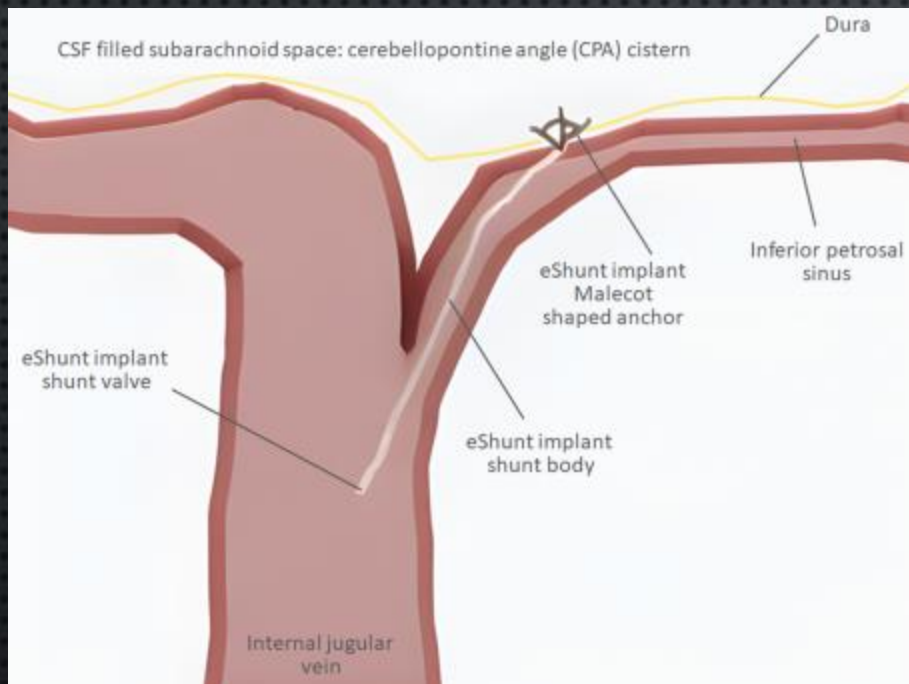
THIRD VENTRICULOSTOMY

- APPEALING BECAUSE NO HARDWARE TO FAIL
- THEORY IS THAT MORE CSF IS PRESENTED TO ARACHNOID GRANULATIONS AND INCREASE CSF ABSORPTION
- DOES IT MAKE SENSE IN THE CLASSICAL MODEL? ARACHNOID GRANULATIONS ARE THE PROBLEM
- SECONDARY NPH IS COMMON, IF AQUEDUCTAL STENOSIS COMPONENT MAKES MORE SENSE
- MAKES THEORETICAL SENSE IN SOME NON-CLASSICAL HYDROCEPHALUS THEORIES

NOVEL STRATEGIES

- ACETAZOLAMIDE
- CHOROID PLEXUS ABLATION
- TPA
- TGF BETA PATHWAY BLOCK
- REMOVAL OF EXTRACELLULAR MATRIX MACROMOLECULES
- REDUCE VASCULAR PULSATIONS
- BRAIN PROTECTION FROM THE EFFECTS OF HYDROCEPHALUS

ESHUNT



UNANSWERED QUESTIONS

- IS NPH REAL? PENS TRIAL
- WHY IS DURABILITY AN ISSUE?
- DOES COGNITION IMPROVE? HYDROCEPHALUS ALLIANCE GRANT
- ASYMPTOMATIC VENTRICULOMEGALLY?