White Matter Injury of Prematurity

- White matter injury of prematurity (WMIP)
- Not the same as germinal matrix hemorrhage (GMH)
  - In WMIP, primary injury is to white matter; in GMH, primary injury is to vessels in germinal matrix
- Periventricular leukomalacia (PVL) = WMIP, but term WMIP is used to emphasize that not all white matter injury is periventricular
- Encephalopathy of prematurity = WMIP and associated neuronal/axonal abnormalities

White Matter Injury of Prematurity

- Primarily initiating factors: Inflammation (due to maternal infection/postnatal sepsis) and ischemia,
- Severity and extent of brain abnormalities = destructive processes and developmental disturbances
- In prematures this white matter zone is a watershed zone between deep and superficial vessels.
- Until recently ischemia was thought to be the single cause of PVL, but probably other causes (infection, vasculitis) play an additional role.
- PVL presents as areas of increased periventricular echogenicity.
- Normally the echogenicity of the periventricular white matter should be less than the echogenicity of the choroid plexus.

Imaging

- **Best diagnostic clue**
  - Best early ultrasound (US) clue: Hyperechoic "flare" with loss of normal tissue echo texture
  - Best early MR clue: T1 hyperintensity and decreased diffusivity (bright DWI, low ADC) in affected areas
  - Best late MR clue: WM volume loss, sometimes with gliosis/ventriculomegaly
  - WM cavitation has become rare in modern neonatal ICUs
- **Location**
  - Focal (most common peritrigonal) or diffuse WM
  - Thalami (may be secondary to WM injury)
  - Often associated with inferomedial cerebellar hemorrhage

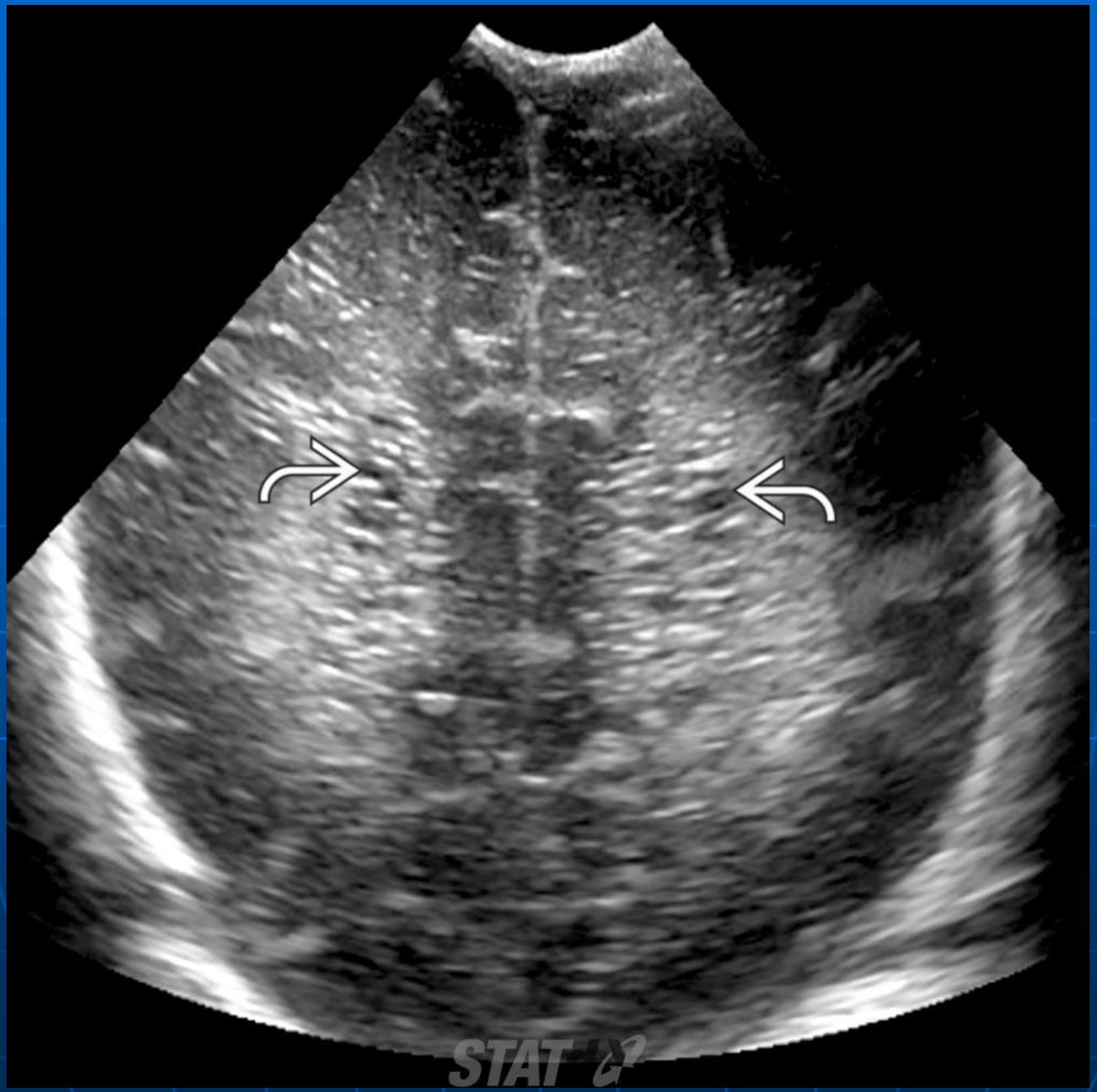
PVL = Increased periventricular echogenicity

Grade 1. Persisting more than 7 days

Grade 2. Developing into small periventricular cysts

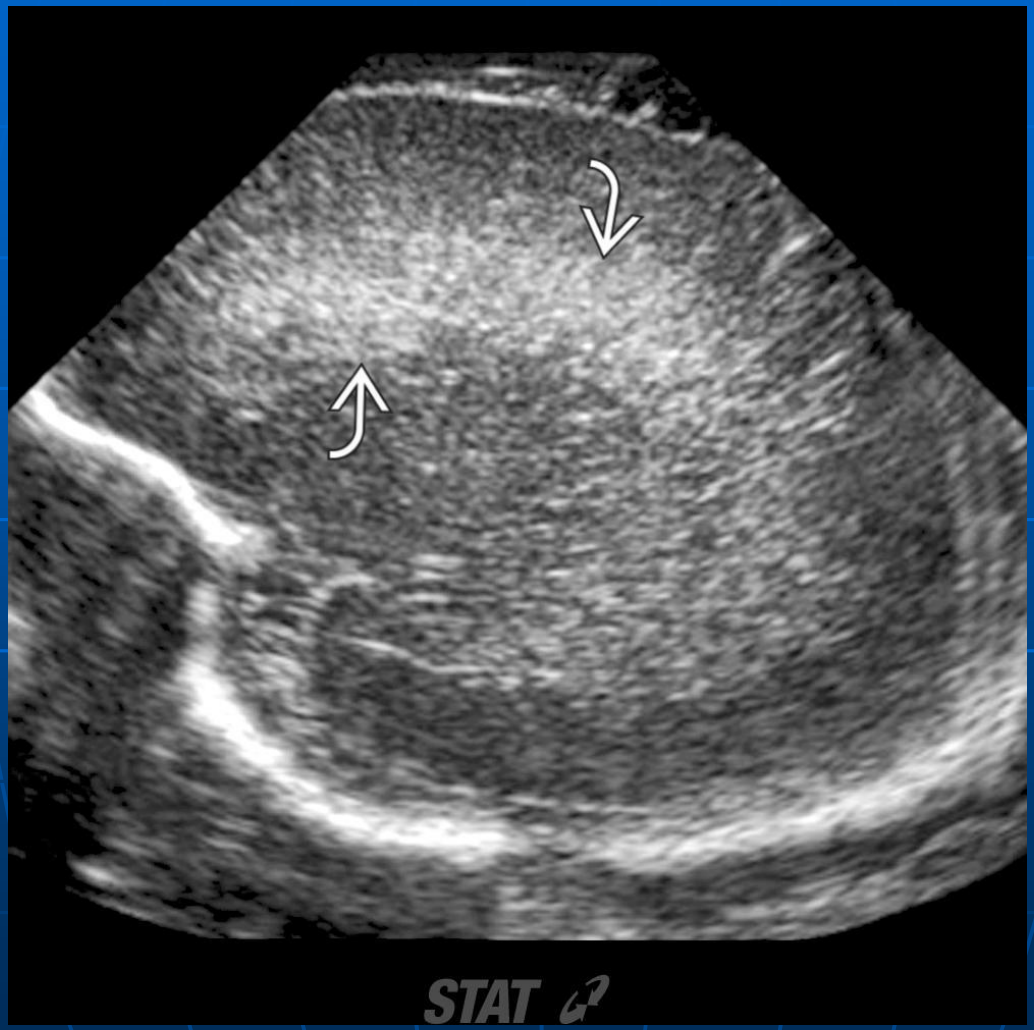
Grade 3. Developing into extensive periventricular cysts, occipital and fronto-parietal

Grade 4. In deep white matter developing into extensive subcortical cysts



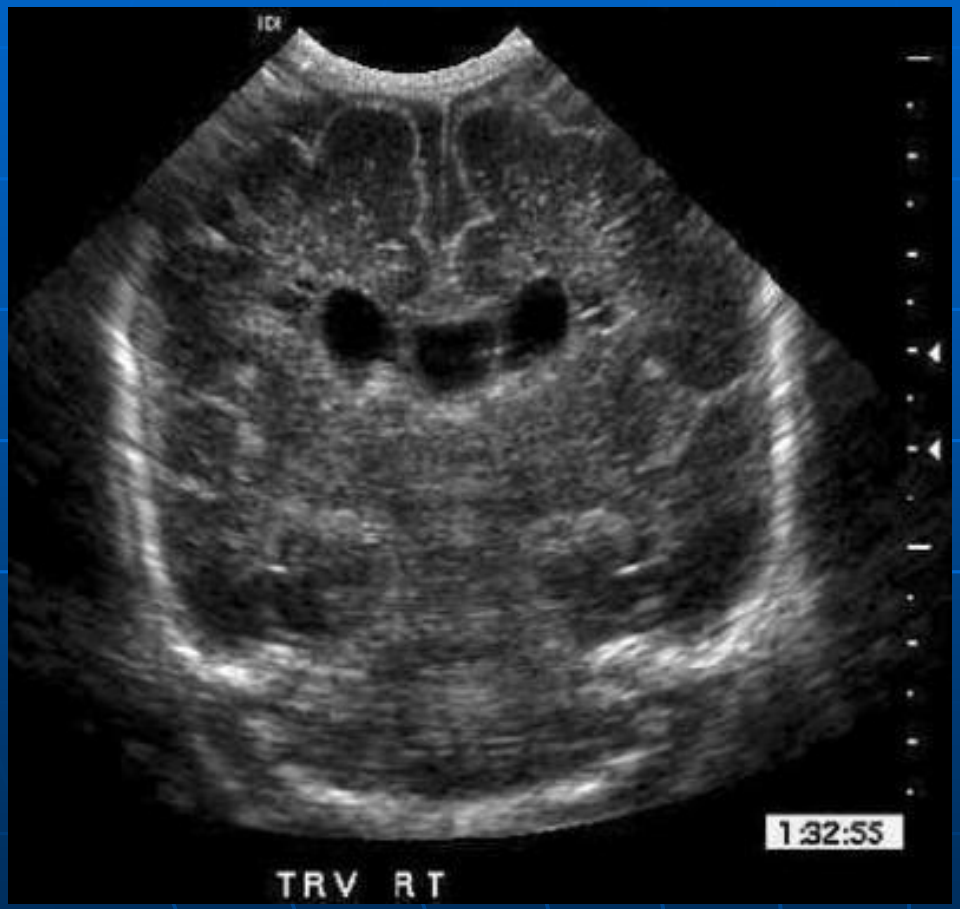
Oblique transfontanelle cranial ultrasound in a 34 week gestational age (GA) infant at 17 days old shows diffusely increased echogenicity throughout the white matter with subtle regions of cavitation (white curved arrow), usually called cystic change.

Grade 1



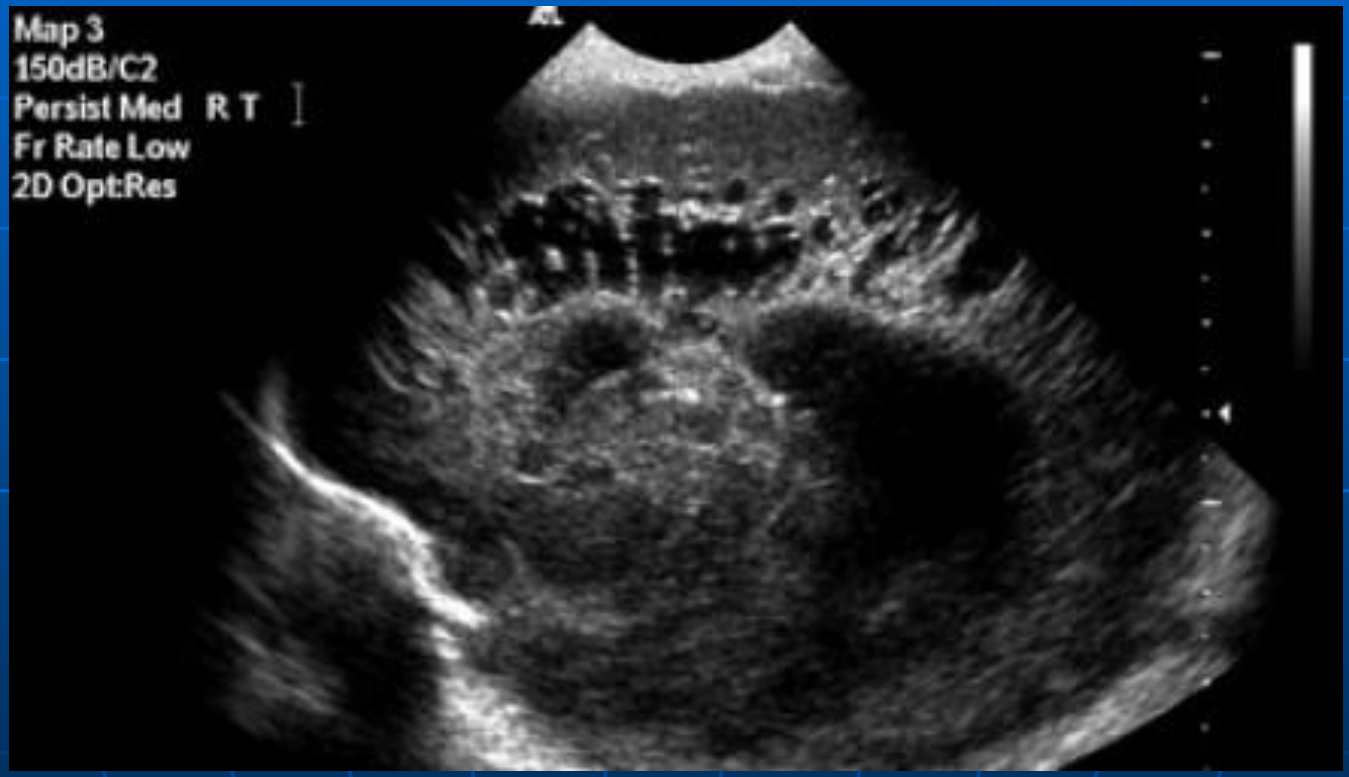
Sagittal oblique transfontanelle cranial ultrasound in a 3-day-old premature infant shows hazy increased echogenicity or hyperechoic "flare" (white curved arrow) throughout the hemispheric white matter.

PVL (grade 2)



PVL (echogenic and cystic in periventricular region)

Grade 3



Grade 4