Radiology Report Grading Guidelines

Background

The goal of this project is to develop a system where someone without clinical training can provide preliminary ratings of clinical radiology impressions (which are notes written by CHOP neuroradiologists but intended for non-radiologists to read). In other words, graders will read a radiology note and rate it as one of three categories:

> **Rating 0**: Suspect serious imaging pathology or unusable scan.
> **Rating 1**: Gray area, neither a 0 nor a 2 (AKA "I'm not sure").[1] These are people who may or may not be included in our analyses as "controls" depending on the context.
> **Rating 2**: No reason to suspect imaging pathology. These are people whose imaging pathology would likely not exclude them from being part of a control cohort in a research brain MRI study.

We often refer to these scans that receive high grader ratings as scans with limited imaging pathology (SLIP). By limited imaging pathology, we mean scans that lack severe pathology or artifacts that might impact or bias downstream analyses. This is an iterative and dynamic process that will be scaled in relation to the needs of the study team. CHOP patients with MRI scans undergo a screening process to prioritize cohorts based on research priorities using factors such as ICD codes, age, prematurity, etc.

We know we aren't going to do a perfect job but want to do as well as possible. Have fun and always remember that no identifying information should ever be on a personal computer! *Please also make suggestions or additions to this document in "Suggesting mode" as you go!*

To help navigate this document, you can use the *outline tab* (three dots and lines at the top left corner of the screen) to navigate through particular anatomical regions and other important information for grading.

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[1] *From time to time we run by repeated questions that come up more than a couple times with a neuroradiologist.*

Extraneous anatomical regions

These regions are extraneous and therefore are largely not relevant for identifying scans with limited imaging pathology. Should there be any intracranial extension of pathology (into our regions of interest), the rating should account for it accordingly.

- **Ethmoid**, **sphenoid**, **maxillary** are terms usually used related to sinuses and not relevant
- **Pallatine tonsils**
- **Cervical nodes**
- **Orbits** generally refers to the bony cavity in the skull that contains the eye, including the nerves, muscles, eyelids, and tear glands and are not relevant
- **External Auditory Canals** generally refers to the extracranial portion of the ears and are not relevant.
- **Spine or spinal cord**

Relevant notes on reports

Prior Scans

- Pay special attention to reports that reference prior scans. They may say things like ‘no problem or new pathology noted,’ but this could be in the context of severe pathology noted on a prior scan that has not changed.

“Act 112 Notification Required: True”

- In Pennsylvania, PA Act 112 aims to address challenges in communicating abnormal imaging findings with patients. The presence of Act 112 Notification Required: True is not a diagnostic term but may warrant caution — consider dropping from 2 to 1, or from 1 to 0

Clinical Indication

- The clinical indication should NOT be exclusively used to rate the radiology report, but can guide ratings in cases that directly impact the brain. In other words, the radiology impression should explicitly denote pathology in order to be given a certain grade. Examples include:
    - Neurofibromatosis/NF1
    - Glioma
    - Mass
    - Traumatic Brain Injury
    - Multiple Sclerosis
    - Chemotherapy/treatment
    - Surgery
    - Sickle Cell Anemia

Artifacts, Imaging Quality, and Type of Scan

Paper Chart

- Generally these scans are a 0, as we do not have access to the paper scans.

Image artifacts (braces, susceptibility, etc.)

- (0) - Severe artifacts
    - Severe orthodontic hardware and significant signal dropout and geometric distortion
- (1) - Mild/minor image artifacts
    - Ex. scalp EEG leads, small susceptibility artifact
- (2) Extracranial/extraneous
    - dental amalgam artifact

Motion artifacts

- (0) - Severely degraded (even if diagnostic)
- (1) - Mild motion/few sequences affected0
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Image Quality/Type/Sequence Impact

- (0) - Nondiagnostic imaging/brain MRI (a term sometimes used for a scan that is insufficient for the radiologist to make a diagnosis (may be acquired as part of an interventional procedure))
- (0) - Non-MRI Reports ONLY present (MRA, MRV, or MR Spectroscopy)
- (0) - Severely limited study or incomplete
- (2) - Diffusion Weighted Imaging (DWI) impacted/ruined/limited
- (2) - Post-contrast imaging impacted/ruined/limited
- (2) - "Per fast screening protocol…"
- (2) - "Evaluation significantly limited…"
- (2) - "DBS surgical navigation protocol (for epilepsy)"

Outside Scans

- Rate normally unless not scan clearly not available (then 0)

Anatomical Regions & Structural Findings

1. Brain Parenchyma & White Matter

General guidelines

- MOST -omas, -otomy, and -ectomy: These are typically 0s except in certain circumstances. They could be 1s or even 2s if they are referring to something *outside the brain*. For example, optic gliomas develop in a cranial nerve and should be a (1)

Specific lesions and structural changes

- (0) - Astrocytoma
- (0) - Chiasmatic glioma
- (0) - Encephalomalacia
- (0) - Glioblastoma
- (0) - Retinoblastoma
    - Post treatment (including orbital prosthesis) as they will have had chemotherapy
- (0) - Optic pathway glioma
- (0) - Leukomalacia
- (1) - Gliosis
- Microhemorrhage
    - (0) - If confirmed and has impact/if seen with additional pathology
    - (1) - If present but part of many differential diagnoses or no impact
- Necrosis/necrotic
    - (0) - If confirmed and has impact/if seen with additional pathology
    - (1) - If present but part of many differential diagnoses or no impact

White matter T2/FLAIR Signal Abnormalities

- (0) - Major signal abnormality, lesions >5mm
- (1) - Small lesions (<5 mm) and signal abnormalities with mild impact
- (2) - Punctuate, small, nonspecific (e.g., hyperintensities or hypointensities)

Atrophy/Volume Loss

- (0) - Encephalopathy
- (0) - Mild ex vacuo dilation
- (0) - Significant brain atrophy
- (0) - Volume loss
    - An alternative phrasing for volume loss can be references to prominence of ventricles and prominence of sulci. If only the ventricles are described as prominent, then it could be either a developmental issue, early ventriculomegaly/hydrocephalus, or volume loss (and graded accordingly).

    - If volume loss is described as mild or subtle then (1)
    - If decreased volume is described as hypoplasia and there is not other concurrent pathology, then usually a (1)
- (1) - Benign Enlargement of the Subarachnoid Space (BESS)
- Macrocephaly
    - (0) - Severe macrocephaly (99th percentile, extended description of parts of the brain that are enlarged, or pathological findings)
    - (1) - if otherwise unremarkable
- Microcephaly
    - (0) - Severe microcephaly (1st percentile, extended description of parts of the brain that are enlarged, or pathological findings)
    - (1) - if otherwise unremarkable

2. Ventricular System & Cysts

General cyst guidelines (some are pathologic, but many are incidental):

- (0) Cystic and solid lesion/significant mass effect, and displacement
- (1) Mass effect is present → context dependent, see arachnoid
- (2) No mass effect (“small, incidental cyst”/”incidental finding of a cyst”)

Specific cysts

- Pineal cyst
    - (2) - incidental, no mass effect
- Arachnoid cyst
    - (0) - With displacement/mass effect
    - (1) - With minimal/without significant mass effect
    - (2) - Without mass effect **at all** → generally uncommon
- Choroid/choroidal fissure cyst
    - (1) - Mass effect described
    - (2) - No mass effect
- Rathke Cleft
    - (0) - With mass effect/displacement
    - (1) - No mass effect
- Dermoid cyst
    - (0) - Intracranial
    - (1) - Extracranial
- Epidermal inclusion cyst
    - (1) - Intracranial with mass effect
    - (2) - Extracranial
- (0) - Epidermoid cyst
- (0) - Neuroglial cyst

- (1) - Germinolytic cyst
- (2) - Choroid plexus cyst
- (2) - Mucus retention cyst

Ventricular Abnormalities

- Hydrocephalus
    - (0) - with mass effect or increased intracranial pressure (ICP)
    - (1) - without mass effect
- Ventriculomegaly
    - (0) - with additional pathology and impact
    - (1) - without any additional pathology

3. Skull & Meninges

General findings

- Dural thickening/enhancement (most common on contrast)
    - (0) - Pathology associated or post-op
    - (2) - Incidental, no concern, no associated pathology
- (0) - Spongiform dysplasia (neurofibromatosis indicator)
- (2) - Skull base lesions, hemangioma, venous lake
- (2) - Postural plagiocephaly (if mild, otherwise unremarkable MRI)

Surgical Findings

- (0) - Craniectomy
- (0) - Craniotomy
- (0) - Any of the following terms related to the brain or skull cap
    - post op/post surgery
    - surgical cavity
    - surgical site
    - resection
    - ventriculostomy
    - shunt
- (2) - Surgery unrelated to brain (e.g., heart/neck surgery with brain MRI) structures

Empty Sella or Partially Empty Sella (part of skull that houses pituitary gland)

- (1) - Finding associated with symptoms (e.g., intracranial hypertension) or where the radiologist seems concerned about it (suggests monitoring, follow up, or checking with clinical indications) AND nothing else
- (2) - Incidental finding of no clinical significance OR Mild empty sella noted as a likely developmental variant

4. Vascular & Perfusion Issues

Arteriopathy & Stenosis

- (0) - Moyamoya with symptoms, arteriopathy with effects
- (1) - Moyamoya/arteriopathy with no apparent effects
- (2) - None/normal perfusion

Hemorrhage & Vascular Malformations

- (0) - Hemorrhage (sizeable), infarct, stroke, epidural/subdural hematoma (acute/large), aneurysm, thrombosis, cavernoma/cavernous malformation, History/concern for prior hemorrhage and in brain parenchyma
- (1) - Minor bleeds (microhemorrhage) or small hemorrhagic changes, epidural/subdural hematoma with chronic or minor impact
- (2) - None, cephalohematoma

Incidental/developmental venous anomaly, no associated pathology (2)

- “Hypoplastic posterior communicating artery”
- “Incomplete Circle of Willis”
- “Absent PComm — anatomical variant” (PComm = posterior communicating artery)
- “Normal Circle of Willis variant”

5. Posterior Fossa & Cerebellum

Chiari & Tonsillar Ectopia

- (0) - Chiari II-IV
- (1) - Chiari I, cerebellar tonsils >5mm
- (2) - Cerebellar tonsils ≤5mm or considered unlikely to have clinical significance
    - If labeled as ectopia, still considered to be a 2

Cerebellar Vermis

- (0) - Moderate/severe vermian hypoplasia
- (1) - Mild hypoplasia or slight widening of the foramen magnum
    - (2) - unless scan is otherwise normal
- (2) - Normal vermis or benign variant

Other

- (0) - Cerebellitis/rhombencephalitis

6. Corpus Callosum & Commissures

- (0) - Agenesis/dysgenesis (complete or severe)
- (1) - Mild dysgenesis
- (2) - Normal or incidental variation, corpus callosum diffusely thicker than anticipated
- (2) - Cavum septum pellucidum
- Absent septum pellucidum
    - (0) - Absent and associated with other pathology (more common findings)
    - (1) - Absent but an isolated finding with no other pathology noted

7. Cortical & Midline Structures

- (0) - Focal cortical dysplasia (type IIb), polymicrogyria, holoprosencephaly (any), septo-preoptic holoprosencephaly, cortical developmental malformation, absent olfactory bulb/sulcus
- Gray matter heterotopia
    - (0) - Heterotopia (large nodules), ectopic pituitary
    - (1) - Small heterotopia nodules (periventricular)
- (2) - Hypothalamic adhesion

8. Hippocampus

- (2) - Incomplete or partial hippocampal inversion
- (2) - Hippocampal sclerosis

9. Brainstem and Cranial Nerves

- (0) - Arteriopathy
- (2) - 7th Cranial nerve asymmetry (if minor/nothing else present)

Clinical Syndromes and Systemic Conditions (confirmed by findings)

Definite Exclusion (0)

- Leukodystrophy or leukoencephalopathy
- Septo-optic dysplasia
- Hypoxic ischemic injury
- MOG demyelination/MOGAD (MOGAD = Myelin Oligodendrocyte Glycoprotein Antibody-Associated Disease)
- Tuberous sclerosis
- Stroke
- Pseudotumor cerebri

- Metabolic conditions with findings (e.g., Kernicterus, Canavan)
- Genetic syndromes with brain involvement (Coffin-Siris, etc.)
- Vasculitis (with corresponding pathology)

Potential Inclusion (1)

- Minor or no direct brain involvement noted
- Optic nerve glioma
- Nasal glioma

Miscellaneous Findings (rating 1 unless otherwise noted)

- Minor cephalic findings (brachycephaly, trigonocephaly)
- Optic neuritis
- Premature suture fusion
- Quadrigeminal cistern lipoma <1cm
- “Finding of questionable clinical significance”

Rating 2: Clear for Inclusion

- No findings or benign incidental variants
- Virchow-Robin spaces (aka enlarged perivascular space)
- No pathology, but the technique limitations are clearly stated (fast-scan protocol, no post-contrast images)
- Overall impression states “unremarkable” and no SLIP/Maybe SLIP indicators present
- Under opercularization of the sylvian fissure (unless it is of uncertain etiology or clinical significance)
- Postural plagiocephaly (if mild, otherwise unremarkable MRI)

Further Suggestions

If anything comes up in grading that you are unsure of and is resolved during a skipped reports meeting, please add it to the table below. We want to ensure that this document is as thorough as possible. Also, feel free to add your suggestions via the suggest option in the top right-hand corner.

Report ID	Reason for Skipping	Resolution	Date of Resolution
	Absent septum	(1) - Absent but an isolated	05/01/2025

	pellucidum* *Different from cavum septum pellucidum	finding with no other pathology noted (0) - Absent and associated with other pathology (more common findings)	

Radiopaedia for New Terms

- https://radiopaedia.org/: written more for radiologists, this resource is quite technical. But it contains a lot of high quality information if you search for a specific term that is confusing.