Yield of MRI in Patients with Spontaneous Deep Intracerebral Hemorrhage

Mark Bishop, MS4

Hudson McKinney, Bryan A. Kirk, Anuj J. Jailwala, Aaron McFarlane, Jackson L. Sullivan, Raghav Agarwal, Kevin D. Hiatt

Atrium Health

Wake Forest University
School of Medicine

Outline

- Background and Purpose
- Methods
- Results
  - CTA Findings
  - MRI Findings
- Conclusion

Background and Purpose

- Hypertensive hemorrhage, typically originating in the deep structures of the brain, is the most common type of nontraumatic intracerebral hemorrhage (ICH).
- Advanced imaging may identify underlying culprit lesions in unexplained ICH, but we hypothesized that the diagnostic yield of brain MRI in these settings would be low.

Acute intraparenchymal hemorrhage centered in the right basal ganglia and internal capsule with mild surrounding edema and local mass effect on the right frontal horn.

Modified Hong Kong Rule

- MRI indicated if one or more are met:
  - Age <55 years
  - No prior history of hypertension
  - Lobar ICH

Examples

- Intraparenchymal hemorrhage (IPH) centered along the left basal ganglia.

Examples

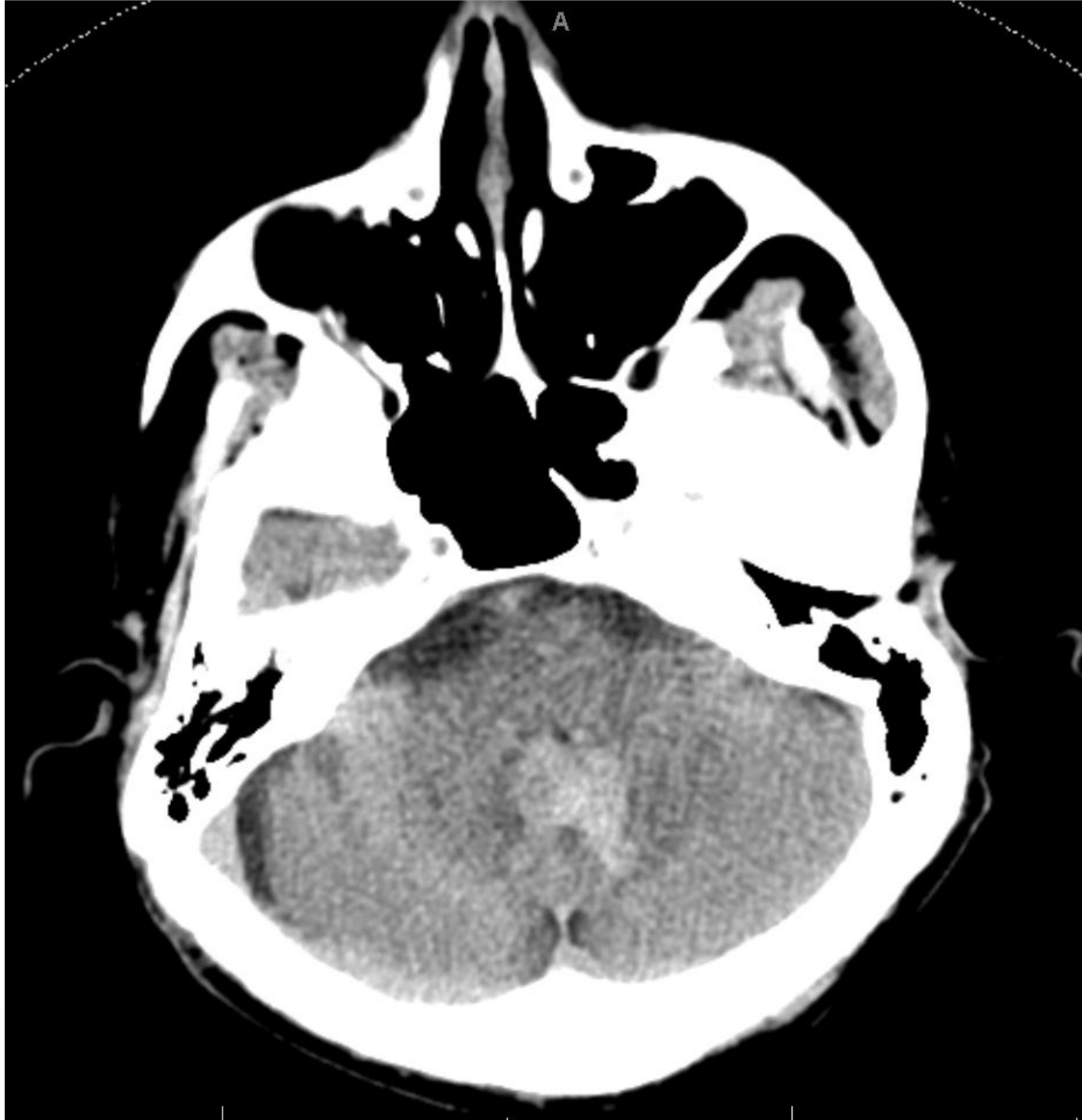
- Acute IPH centered in the right thalamus extending across the posterior limb of the right internal capsule into the subinsular region.

Examples

- Acute midbrain hemorrhage with intraventricular hemorrhage expanding the third ventricle with small amount of hemorrhagic extension into the Sylvian aqueduct.

Examples

- Acute IPH within the medial aspect of the left cerebellar hemisphere extending into the posterior lobe of the cerebellar vermis.

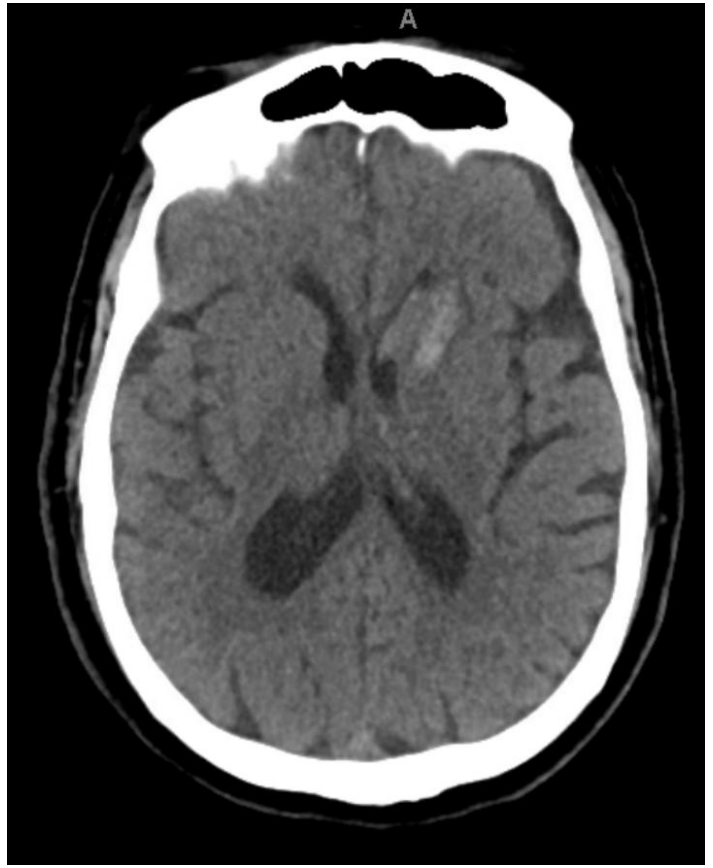


Examples

- Ovoid hematoma in the right external capsule deforming the right putamen.

Methods

- Performed retrospective review of spontaneous ICH cases over a 5-year period, excluded cases with a known etiology.
- Patient history, demographics, initial blood pressure, and results of the initial noncontrast head CT and subsequent imaging studies were recorded.



Small (less than 30 mL) acute intraparenchymal hematoma in the left basal ganglia, with typical location for hypertensive hemorrhage

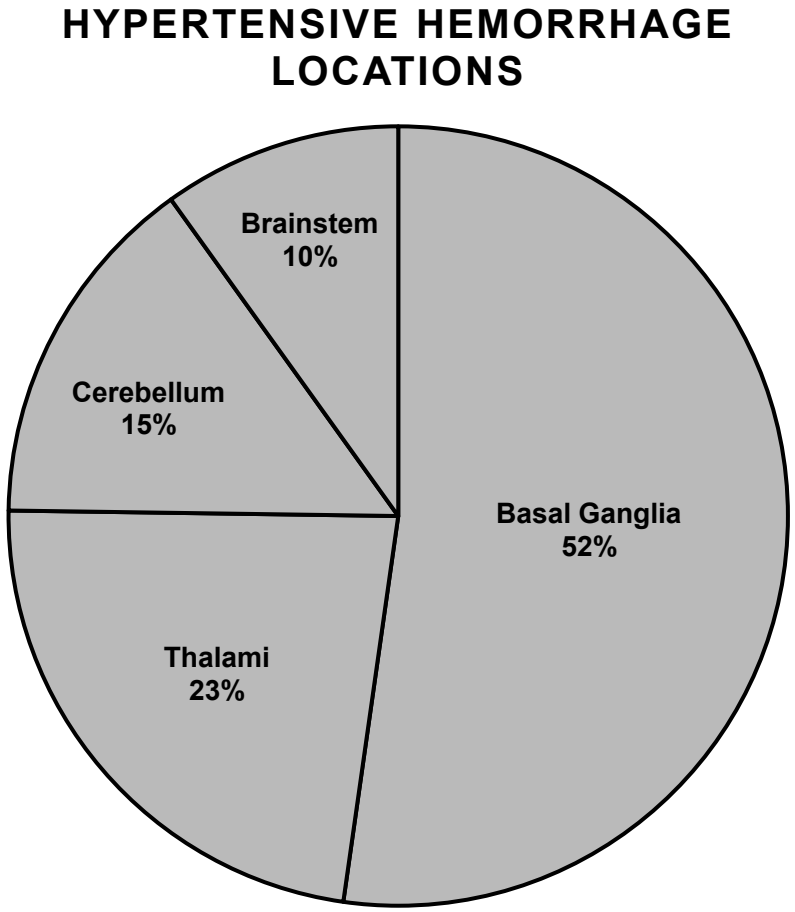
ED Triage Vitals		
BP	02/16/18 1151	(!) 210/110
MAP (mmHg)	02/16/18 1200	160
Pulse	02/16/18 1151	(!) 137
Resp	02/16/18 1151	(!) 29
Temp	02/16/18 1158	99.4 °F (37.4 °C)
SpO2	02/16/18 1151	99 %

Atrium Health

Wake Forest University School of Medicine

Results

- 222 patients met study inclusion criteria:
  - Median age of 67
  - 43.2% female sex
  - 188 patients (84.7%) had a history of hypertension
  - 14 (6.3%) had a urine drug screen positive for cocaine or amphetamines during their hospital admission.
- 173 of the patients (77.9%) were hypertensive (mean arterial pressure >100 mmHg) on arrival.
- Hemorrhage Locations:
  - 116 (52.3%) in the basal ganglia or internal capsules
  - 51 (23.0%) in the thalami
  - 33 (14.9%) in the cerebellum
  - 22 (9.9%) in the brainstem.

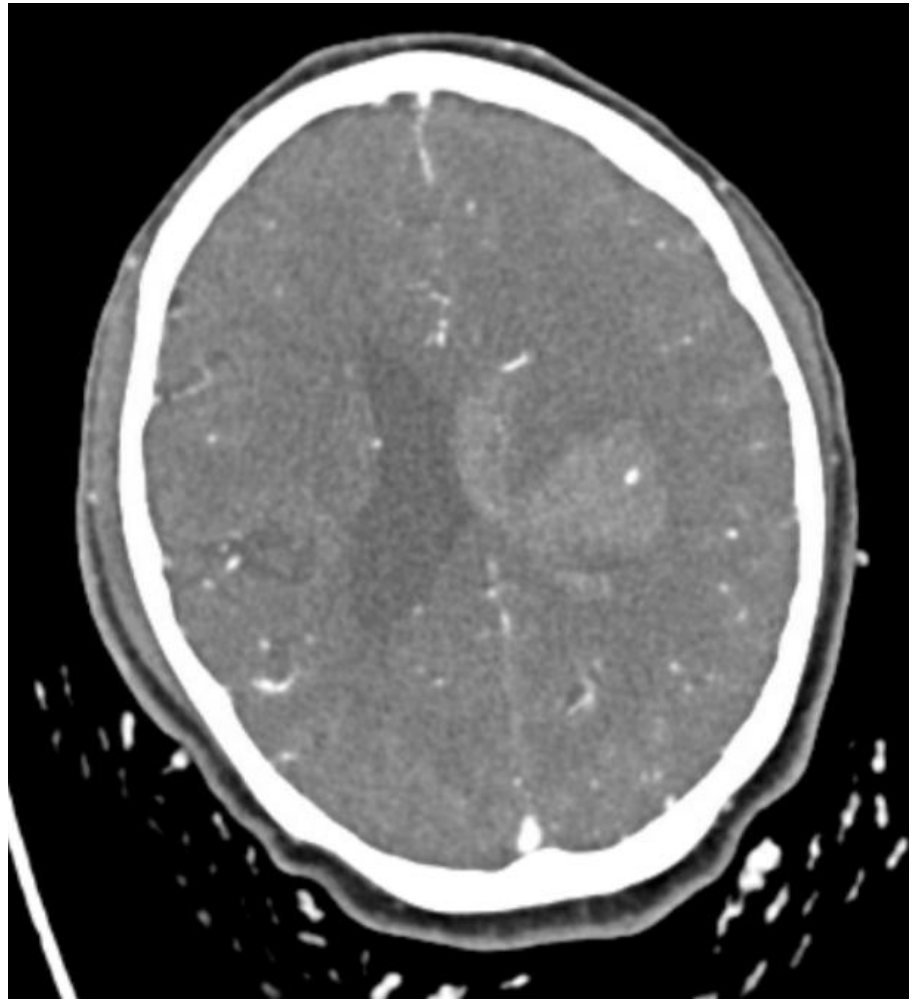


Atrium Health

Wake Forest University School of Medicine

CTA Results

- Head CTA was obtained in 161 (72.5%) of the patients. An underlying vascular lesion was demonstrated in only 1 patient (dural arteriovenous fistula) and a “spot sign” was seen in 17 patients.
- Hematoma expansion occurred in 49 patients overall (22.1%) and in 9 of the patients with a positive “spot sign” on CTA (52.9%).

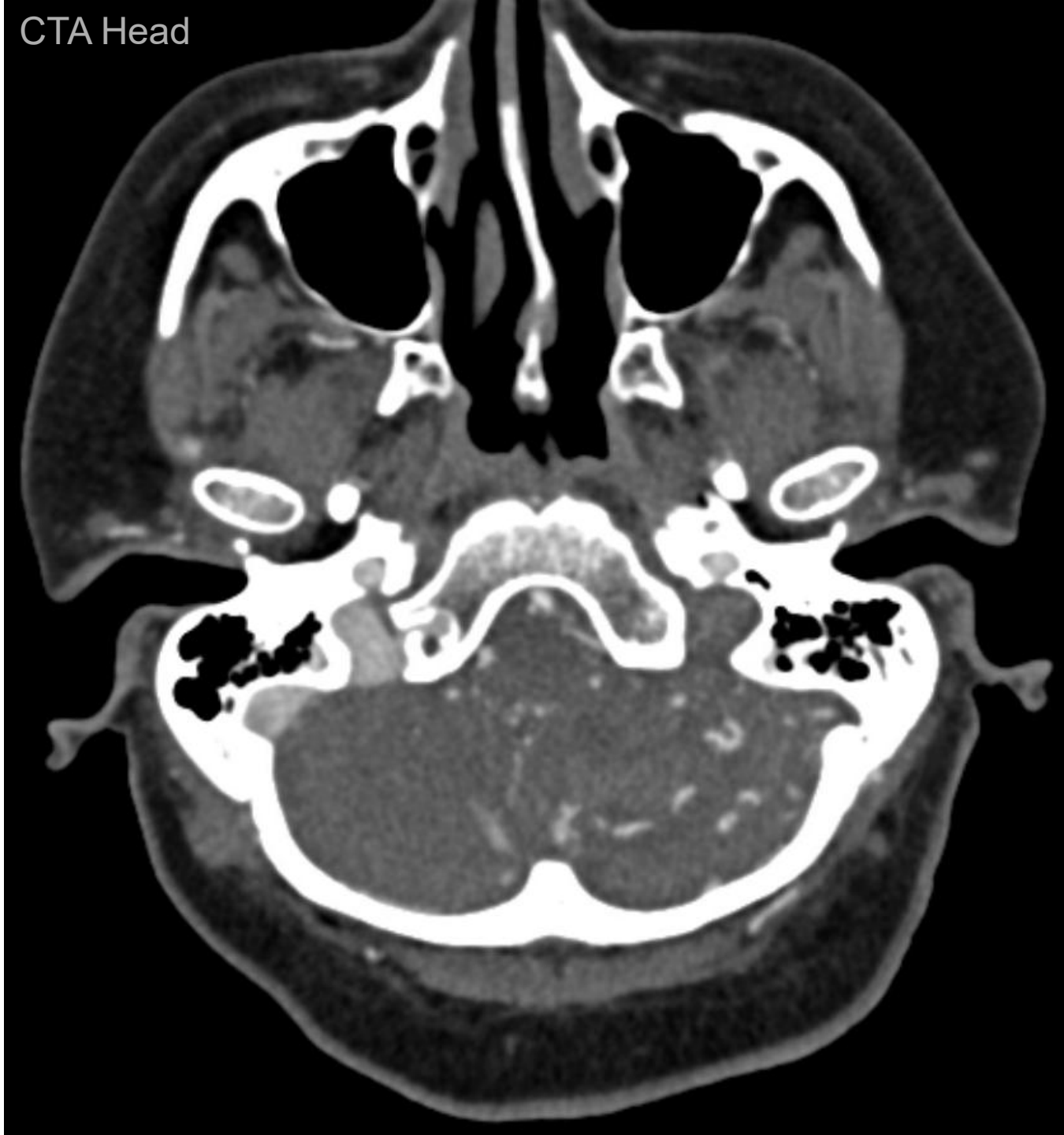


CTA Results Cont.

- Acute parenchymal hematoma centered in the medial left cerebellar hemisphere with extension into the fourth ventricle.

CTA Results Cont.

- Thrombosed left sigmoid sinus and jugular bulb.



CTA Underlying Lesion

- Previously demonstrated venous sinus thrombosis and asymmetrically prominent venous structures around left cerebellar hemisphere on the MIP are suggestive of dural AV fistula.

MRI Results

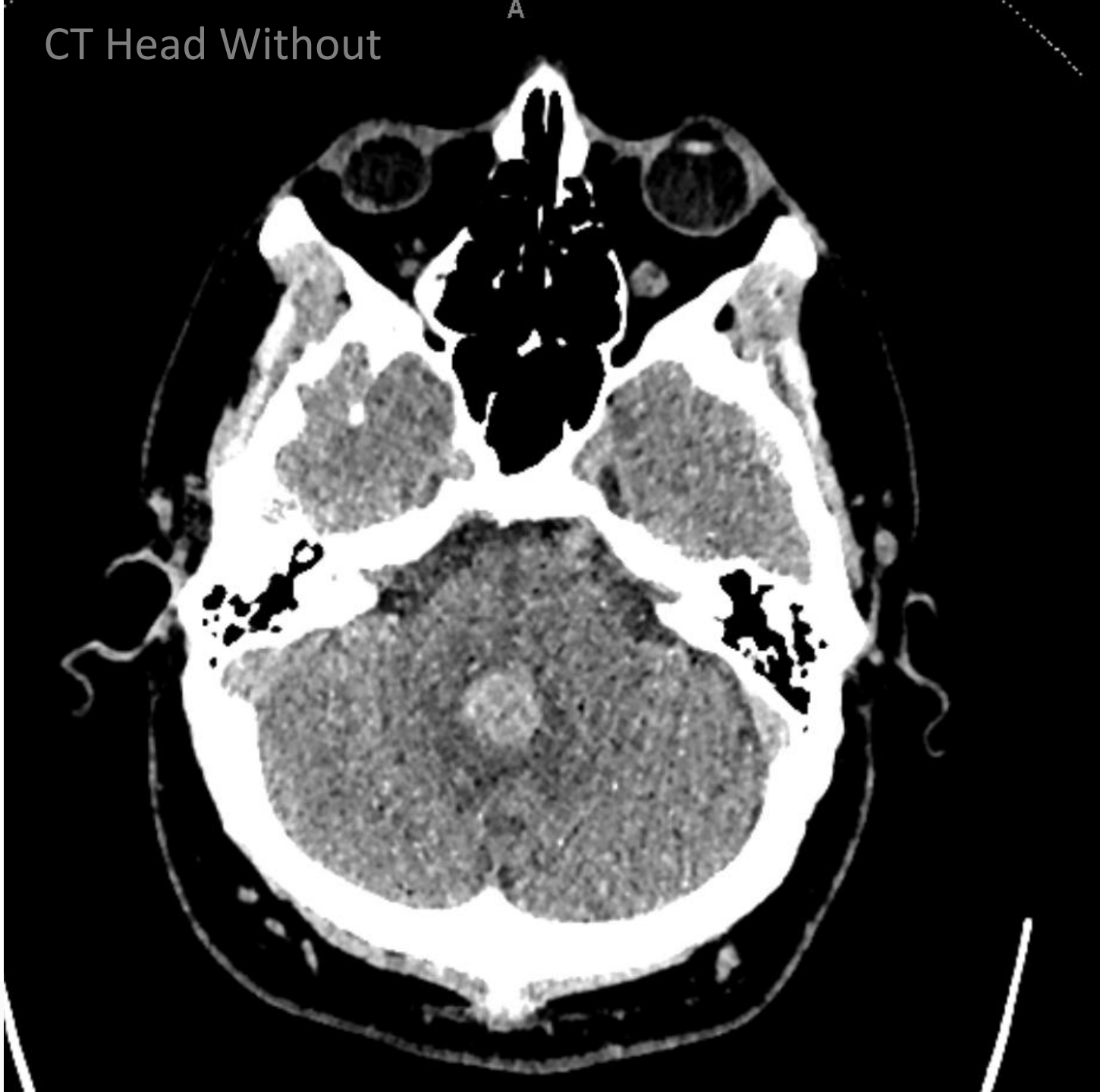
- Brain MRI was obtained for 120 (54.1%) patients at a median interval of 0.97 days following initial head CT, and of these studies, 85 (70.8%) included postcontrast imaging.
- Only 1 MRI study (0.8%) identified a culprit lesion, which was initially interpreted as a probable hemangioblastoma adjacent to a cerebellar hematoma.

Atrium Health

Wake Forest University School of Medicine

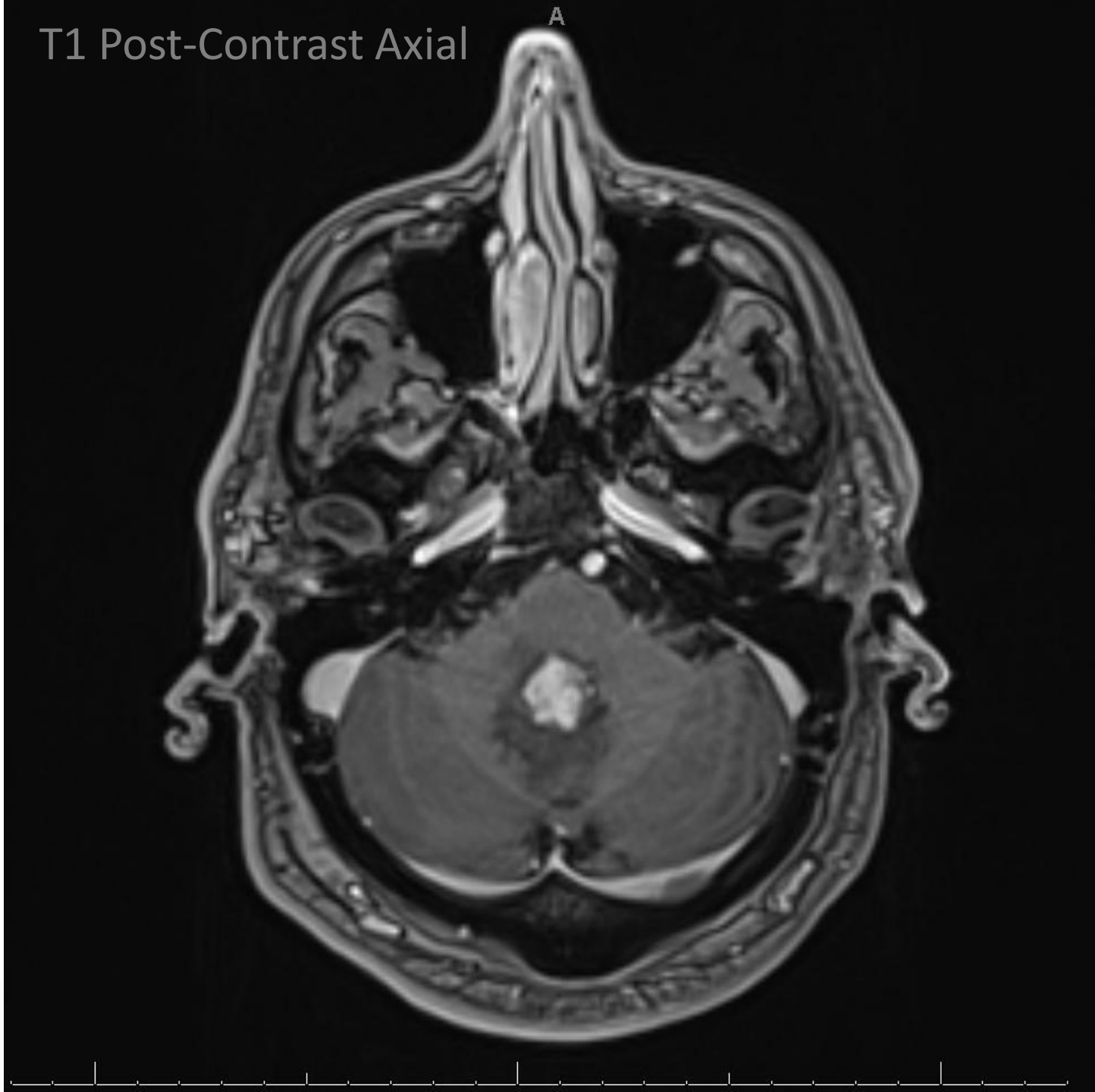
MRI Results

- Rounded acute parenchymal hematoma centered in the inferior vermis



MRI Results

- Enhancing lesion measuring 1.9 cm along the ventral aspect of the cerebellar vermis with adjacent edema signal. Differential considerations include a primary CNS neoplasm such as hemangioblastoma (favored) or solitary metastatic lesion



MRI Results

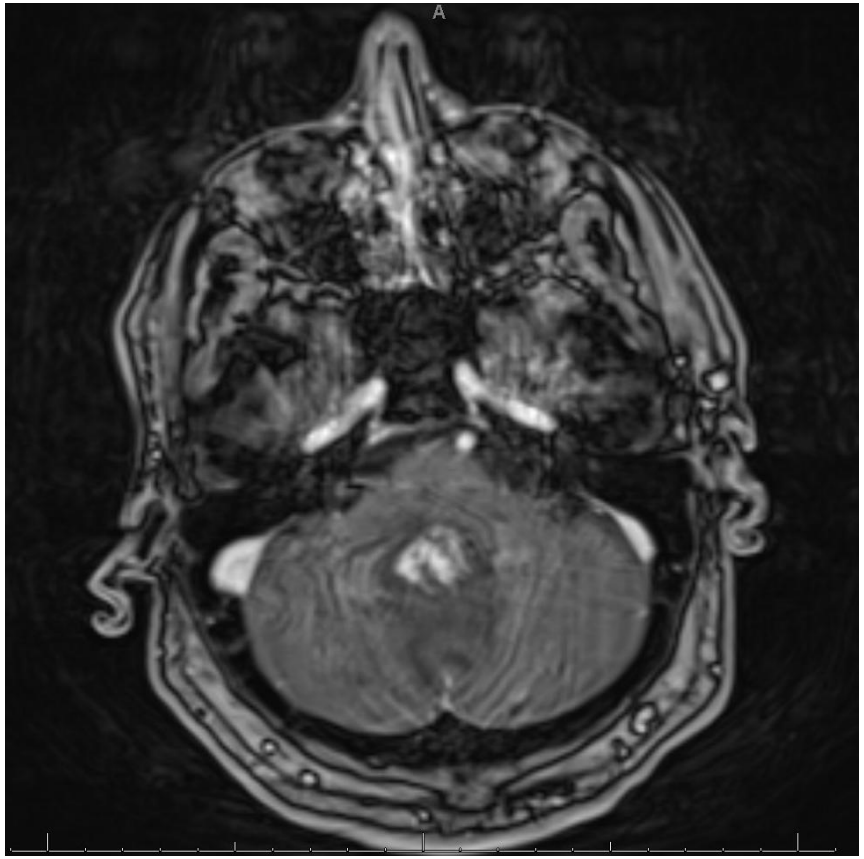
- Enhancing lesion measuring 1.9 cm along the ventral aspect of the cerebellar vermis with adjacent edema signal. Differential considerations include a primary CNS neoplasm such as hemangioblastoma (favored) or solitary metastatic lesion

Case Cont.

- Patient discharged on dexamethasone taper.
- Presented 4 days later with ataxia, nausea, and vomiting.
- Repeat imaging was obtained.

T2

T1 Post-Contrast



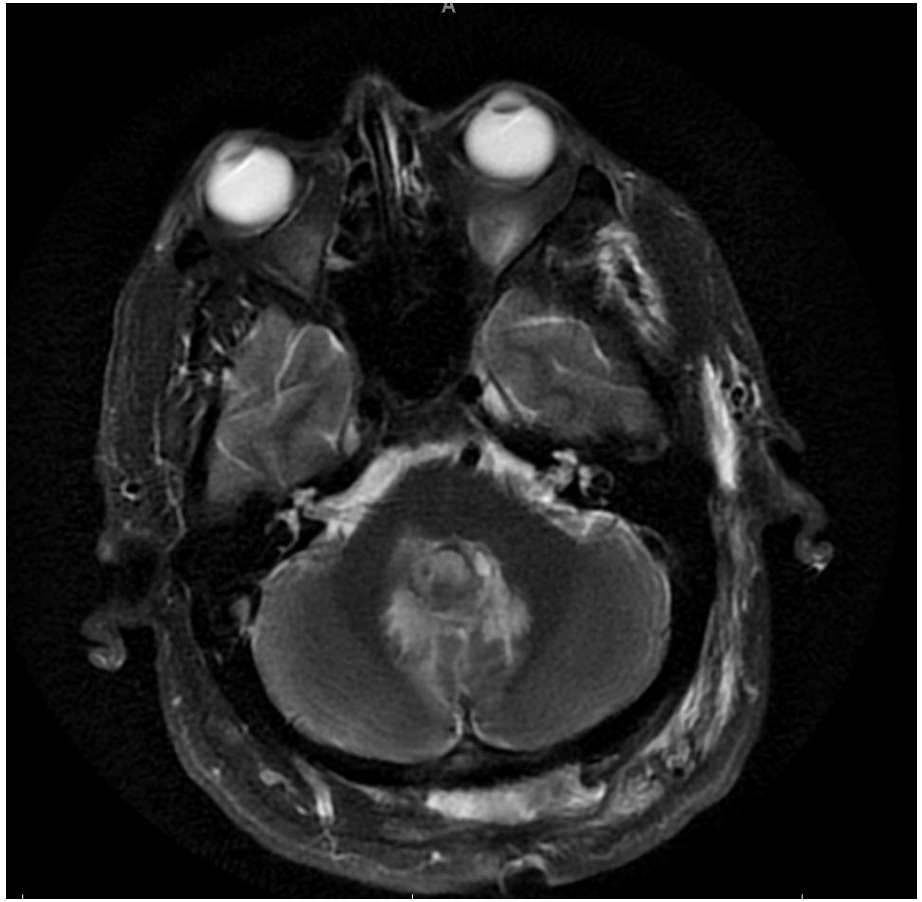
- In comparison with prior brain MRI, there has been slightly increased size of avidly enhancing, T2 hyperintense mass lesion centered along the ventral aspect of the cerebellar vermis.

- Slightly increased surrounding edema with worsening hydrocephalus and transependymal flow of CSF. Primary differential considerations include hemangioblastoma, ependymoma, and solitary metastasis.

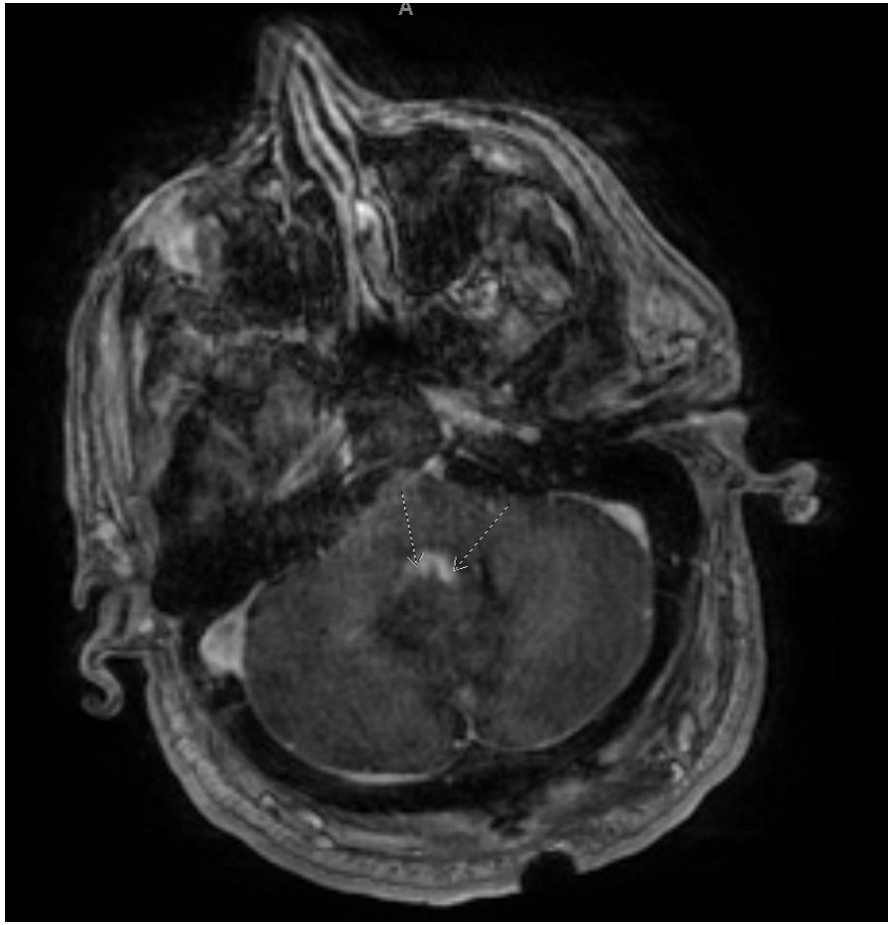
Case Cont.

- Patient received craniotomy for total cerebellar tumor resection.

T2



T1 Post-Contrast



- Postsurgical changes of recent suboccipital craniotomy and debulking of avidly enhancing mass along the anterior vermis protruding into the fourth ventricle.

Case Cont.

- Pathologic diagnosis:
  - Pilocytic Astrocytoma

Final Pathologic Diagnosis

A. BRAIN, CEREBELLUM, BIOPSY:
Pilocytic astrocytoma, WHO grade 1.
Focal hemorrhage.
See Comment and Special Stains.

B. BRAIN, CEREBELLUM, BIOPSY:
Pilocytic astrocytoma, WHO grade 1.
Hemorrhage and focal acute inflammation.
See Comment.

Comment

The biopsies demonstrate a bland glial neoplasm with mild nuclear pleormophism, relatively low cellularity, and hyalinized vasculature. Rosenthal fibers and occasional eosinophilic granular bodies are present. Mitotic activity, endothelial proliferation, and necrosis are not appreciated. Hemorrhage and focal acute inflammation are also present.

Conclusion

- Brain MRI obtained in the acute evaluation of patients with likely hypertensive ICH rarely uncovers a culprit lesion.
- Clinical Relevance/Application: Routine ordering of brain MRI in cases of probable hypertensive hemorrhage should be reconsidered, especially in patients not meeting the modified Hong Kong Rule.

Thank you!