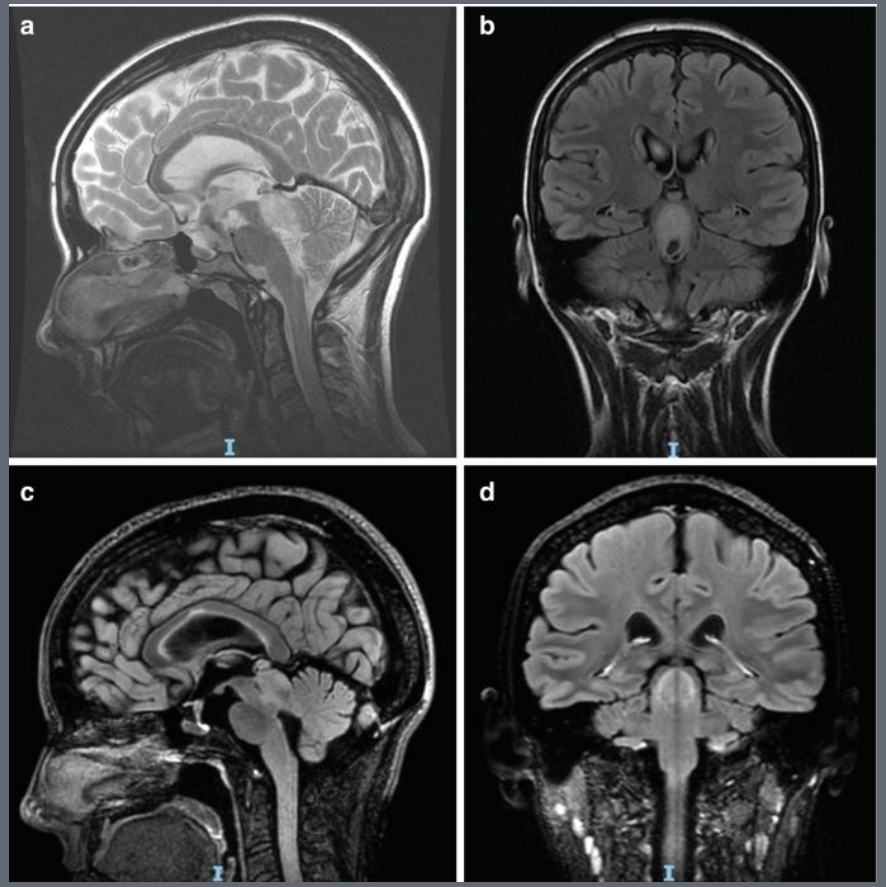


Brain Tumor

Identification & Treatment Recommendation System

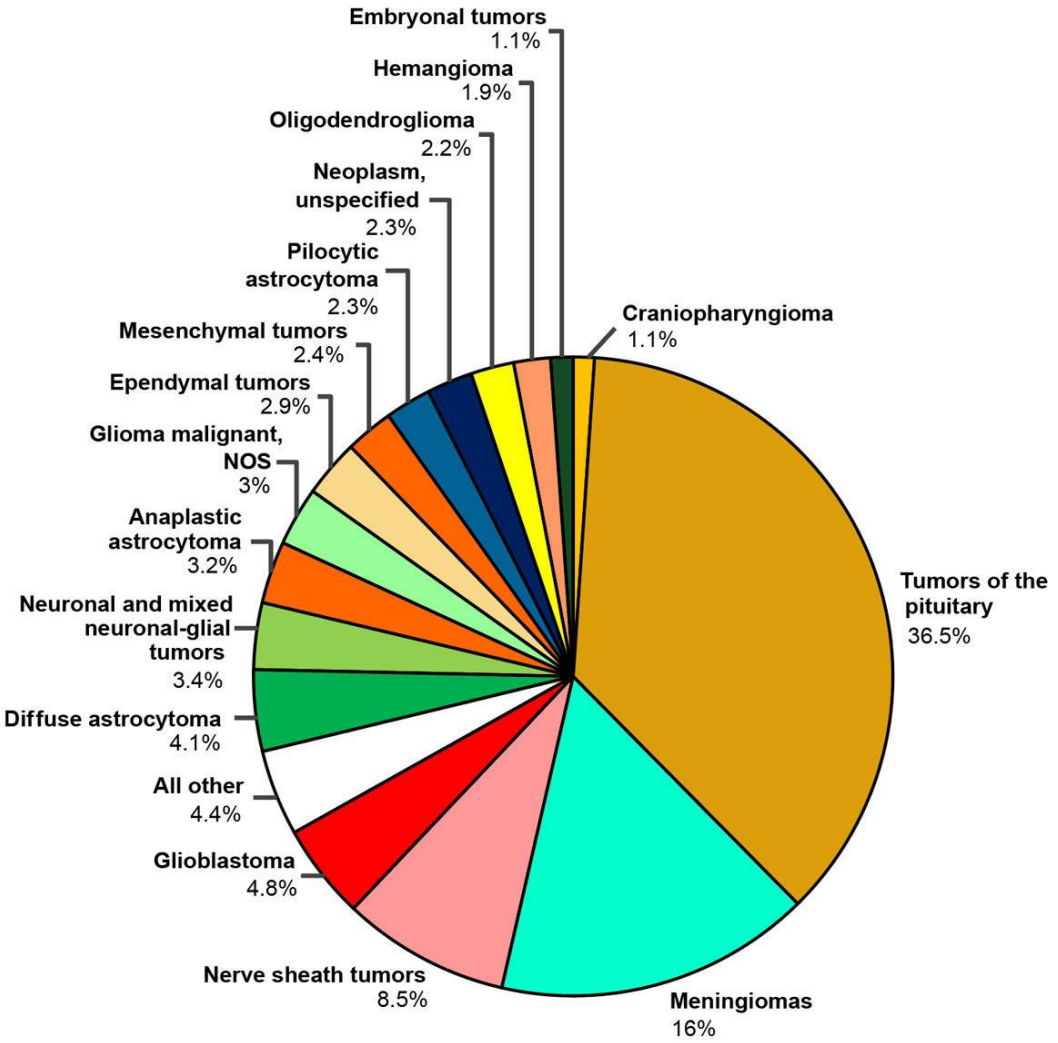
Noah C. Strevell

BrainStation

Data Science Bootcamp

Overview

- **Goal**: Speed up the diagnostic / treatment outline process so that treatment can commence faster.
- 2024 was the first year where there were +2 million new cancer cases in the USA.
- Get a diagnosis and begin to formulate a treatment plan prior to biopsy results.



Breakdown

Stage 1

Identification with MRI Images

I will identify tumor presence and type utilizing a support vector machine (machine learning). Included in the data are images for the following tumor types:

- Glioma
- Meningioma
- Pituitary
- No Tumor

Stage 2

ID (w/ subcategory) via Patient Data and MRI ID result

Using the result from Stage 1 in combination with patient data we will create a model to predict the cancer type and subtype. Such patient data includes

- Sex
- Age
- Race
- Allergies
- Comorbidities

Stage 3

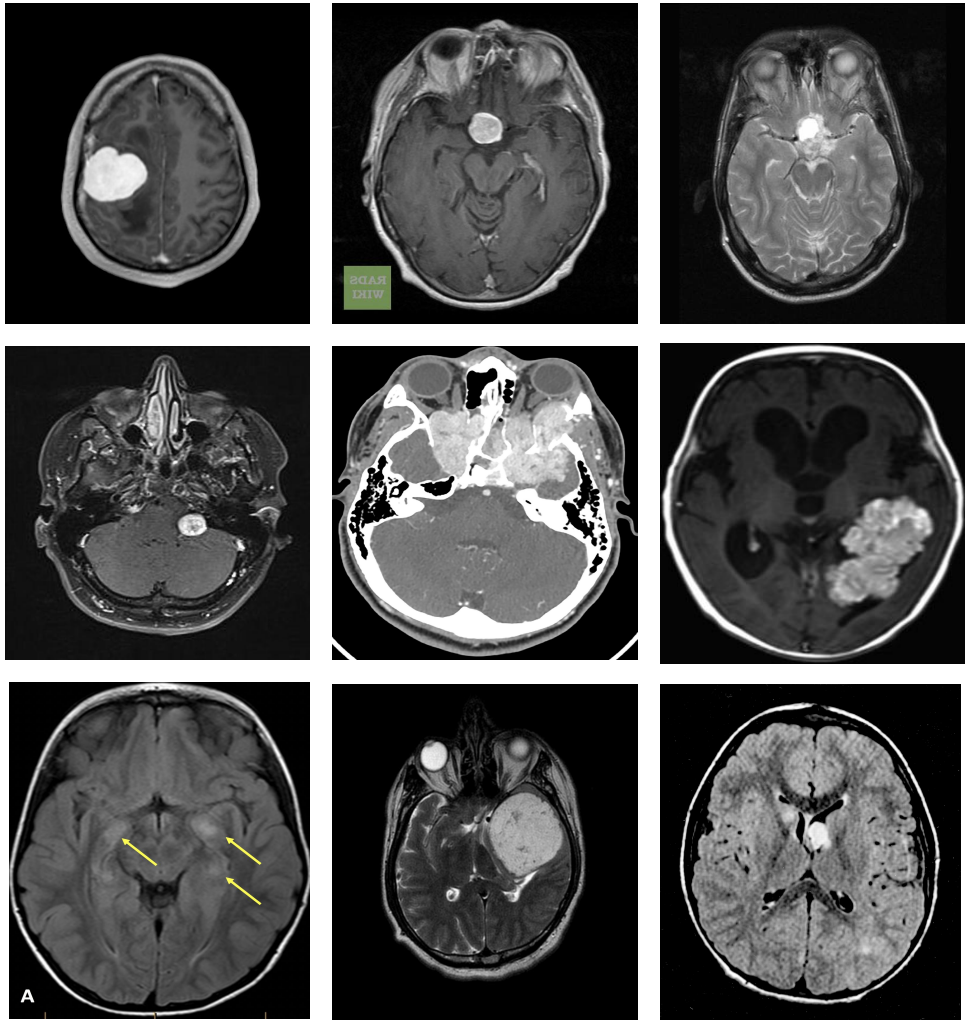
Treatment Recommendation

In combination with patient data, predicted cancer type, and previous treatment data, a suggested treatment plan will be recommended. This is based on the following:

- Cancer type (detailed)
- Patient data (listed above)

I will identify tumor presence and type utilizing a support vector machine (machine learning). Included in the data are images for the following tumor types:

- Glioma
- Meningioma
- Pituitary
- No Tumor



01, Meningioma
02, Pituitary Macroadenoma
03, Craniopharyngioma
04, Schwannoma
05, Nasopharyngeal Angiofibroma
06, Choroid Plexus Papilloma
07, Neurofibromatosis
08, Chondrosarcoma
09, Giant Cell Tumor

Patient Data

Factors

Age

Brain tumors are the most common cancer in children. Peak cancer incidence is between 65 - 84 years.

Sex

Men are 60% more likely to develop glioblastoma than females.

Allergies

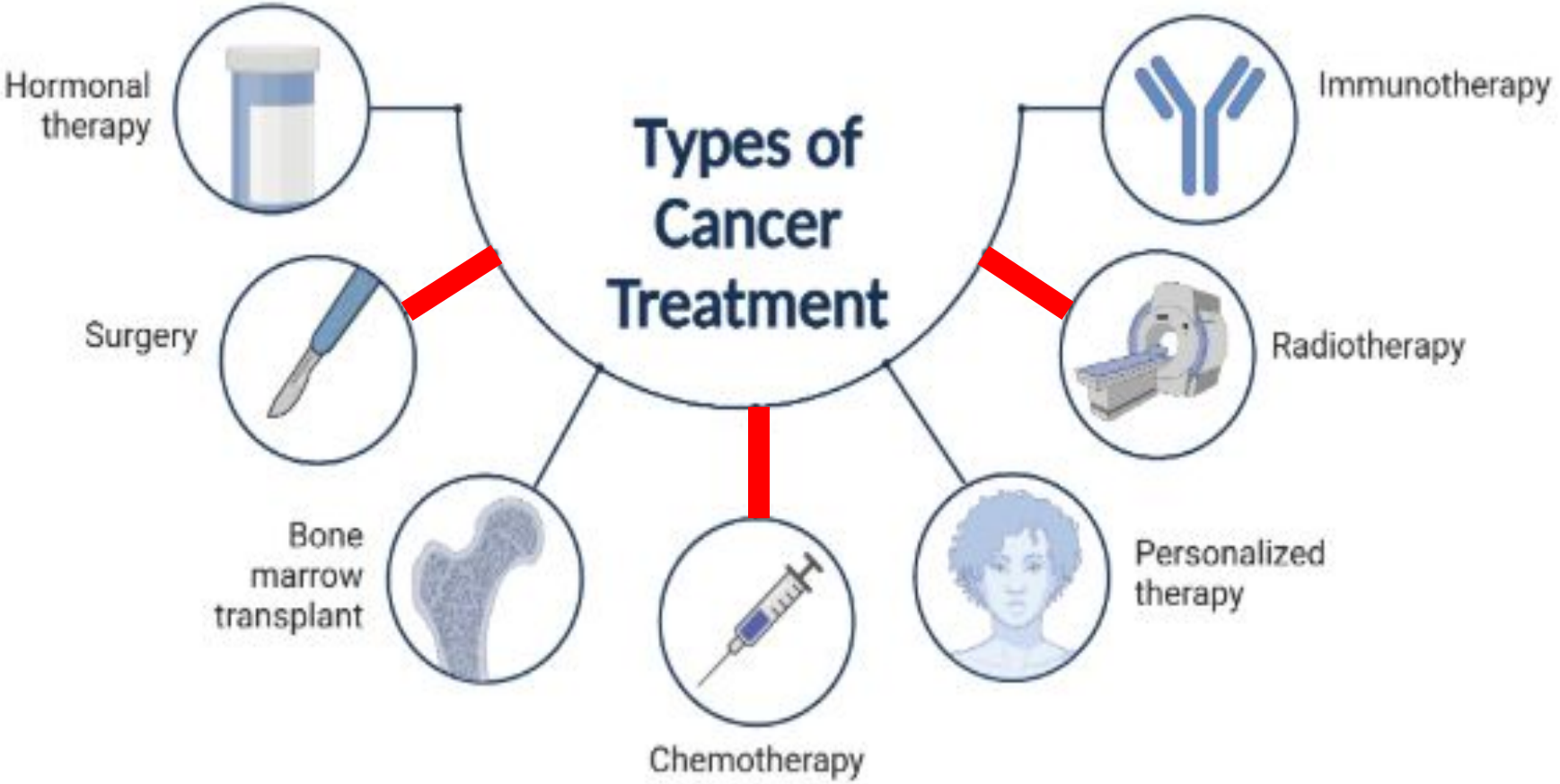
People with a history of allergies have a lower risk of developing gliomas

Race

Meningiomas are more common in black people, and gliomas are more common in white people.

Head Trauma

People who experience head trauma are 4X more likely to develop brain cancer.


Types of Cancer Treatment
Hormonal therapy
Surgery
Bone marrow transplant
Chemotherapy
Personalized therapy
Radiotherapy
Immunotherapy

Brain Tumor ID-Rec System Value

Efficiency	The faster treatment starts, the better the prognosis.
Education	For students familiarizing themselves with different treatment options, this could prove to be a valuable resource.
Insurance	Insurance companies can better predict the treatment and cost of patients. Cancer treatment can range from $100k - $1m.
Biopsy Risk	Depending on the location of the tumor, collecting a biopsy sample can pose risk to the patient and may not be the best approach.

Patient & Treatment Data

- **Glioma** (MSK, Clin Cancer Res 2019)
- **Brain Lower Grade Glioma** (TCGA, PanCancer Atlas)
- **Brain Lower Grade Glioma** (TCGA, Firehouse Legacy)
- **Diffuse Glioma** (GLASS Consortium, Nature 2019)
- **Diffuse Glioma** (GLASS Consortium)
- **Diffuse Glioma** (TCGA, GDC)
- **Glioma** (MSK, Nature 2019)
- **IDH-mutated Diffuse Glioma** (MSK, Clin Cancer Res 2024)
- **Low-Grade Gliomas** (UCSF, Science 2014)
- **Pheochromocytoma and Paraganglioma** (TCGA, Cell 2017)
- **Pheochromocytoma and Paraganglioma** (TGGA, Firehouse Legacy)
- **Pheochromocytoma and Paraganglioma** (TCGA, PanCancer Atlas)
- **Meningioma** (University of Toronto, Nature 2021)
- **Pituitary Adenoma** (MSK, Acta Neuropathologica 2024)

14 Datasets
4,969 patients
Collected from: https://www.cbioportal.org/

MRI Data

- MRI for Brain Tumor with Bounding Boxes
  - Training Set
    - Glioma: 1,153 images
    - Meningioma: 1,449 images
    - No Tumor: 711 images
    - Pituitary: 1,424 images
  - Validation Set
    - Glioma: 136 images
    - Meningioma: 140 images
    - No Tumor: 100 images
    - Pituitary: 136 images

5,249 high-quality MRI images (w/ annotation)
YOLO format
Collected from: kaggle.com

Concerns

Potential risk factors and areas

Multiple Data Sources

The patient and treatment data being used is spread across 14 different data frames. There are collection discrepancies, feature differences, etc. Accurate compilation of data from multiple sources requires meticulous construction via concatenation

Ethical Concerns

Not intended to replace expert medical diagnosis or advice.

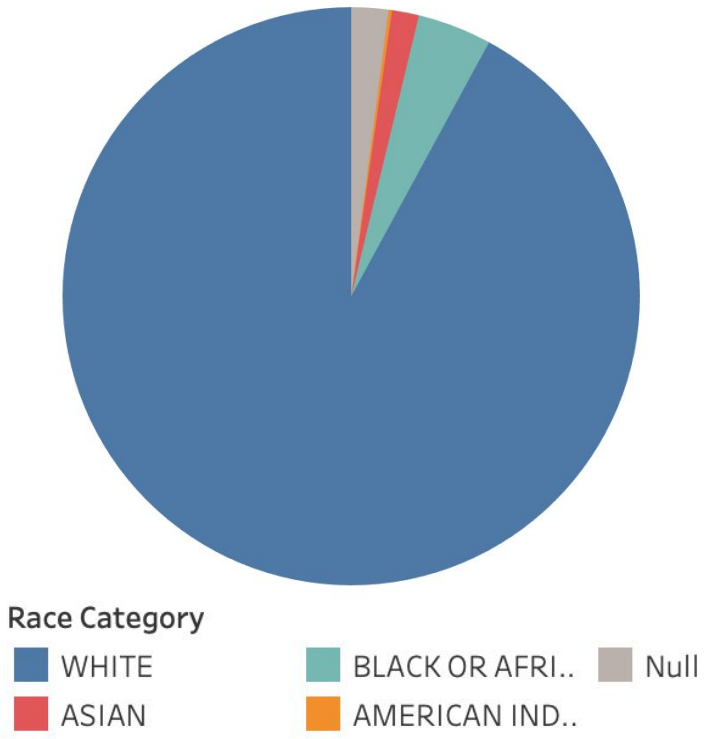
Genetic Information

Although some data sources included genetic information, bioinformatics have not been included in this project because of the exclusion of biopsy data (this is done to improve initial test efficiency)

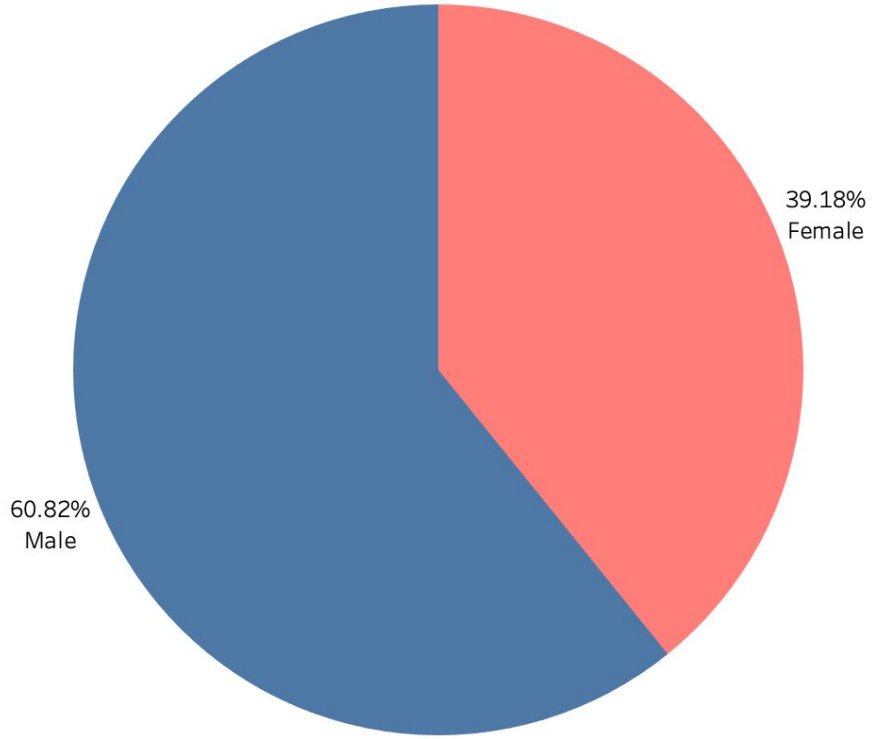
Only 3 types of tumors

Included in the MRI data are images of only three types of brain tumor. Ideally, there would be a wider array of brain tumors.

Glioma
Race Ratio



Glioma
Male / Female Ratio



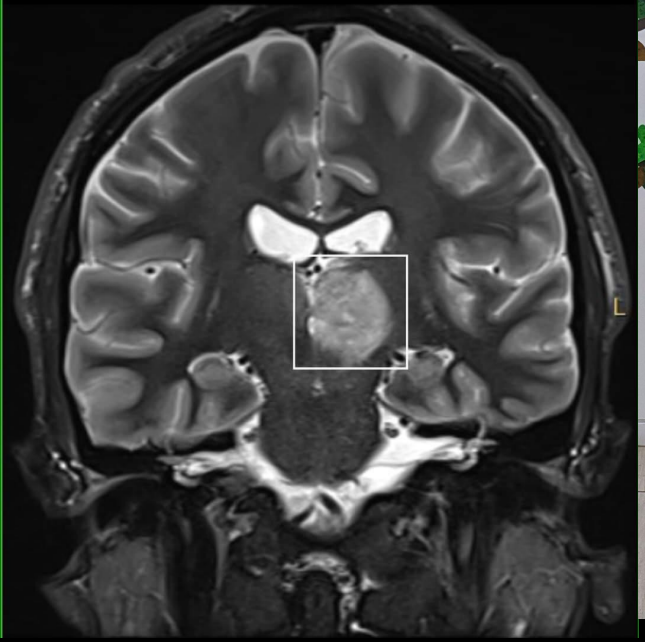
Most Frequent Subtypes

1. Glioblastoma Multiforme (53.69%)
2. Anaplastic Astrocytoma (15.84%)
3. Aligodendroglioma (10.16%)
4. Diffuse Astrocytoma (11.55%)
5. Anaplastic Aligodendroglioma (4.58%)
6. Gliosarcome (1.79%)
7. Diffuse Glioma (1.49%)

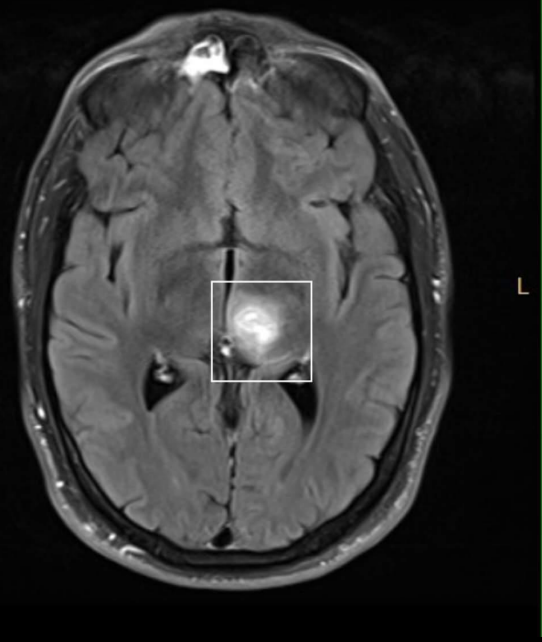
My Story

Noah C. Strevell

STREVELL, NOAH CHASWORTH NYU LANGONE TISCH
16475944 M/(25Y) SIEMENS, Skyra
Accession no.: 36468881 Thickness 4.0 mm
COR STIR 320 x 224
Jun 27, 2023 7:30 PM
TE 51ms - TR 3.0s
Flip Angle 134°
Series 8 - Image 28
Slice Pos.: 11.7 mm



STREVELL, NOAH CHASWORTH NYU LANGONE TISCH
16475944 M/(25Y) SIEMENS, Skyra
Accession no.: 36468881 Thickness 5.0 mm
AX FLAIR 320 x 224
Jun 27, 2023 8:04 PM
TE 81ms - TR 9.0s
Flip Angle 150°
Series 20 - Image 16
Slice Pos.: 1.1 mm



Thank you!