A Retrospective Contrast of Artificial and Human Intelligence in Brain Tumor Classification

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Abstract: The Central Nervous System comprising of brain and spinal cord responsible for your everyday activity, from your cognitive function, memory, thinking, speaking, maintaining hemostasis, to reflex actions are controlled here. Basically, a small damage to your brain may shake the normal rhythm of life. This is a retrospective description that has observation of 10 different brain tumor patients from the Republican Hospital of Samarkand, 2025 outline. In the collection of patient cases of brain tumors, there are 10% pediatric cases, 20% from age range (20-60) and 60% from age range (50-80). Discussion: In this retrospective discussion, the study is dependent on completeness of data records, and it is extracted from single center, with no direct applications of AI, for only comparisons are made. Conclusion. This study highlights manual staging if tumor that remains vital and it's limitations are inherent with emerging AI technologies, hence global health being the major impact.

Keywords: global burden, brain tumors, neuro quant, manual staging, retrospective literature.

Introduction: Central Nervous System comprising of brain and spinal cord responsible for your everyday activity, from your cognitive function , memory , thinking, speaking, maintaining hemostasis, to reflex actions are controlled here. Basically, a small damage to your brain may shake the normal rhythm of life.

Universal burden of brain tumors has different incidence rates, mortality counts, and hard challenges, when early detection can just delay the obstacle and treat the symptoms to some extent. CNS cancers have ranked on 19th for being the most malignant ones and 12th for major cause of demise [1] . As of 2025 across continents, estimated new cases of brain tumors are 28,820 of all new 1.2% cases. And mortality number is 18,330 out of 3.0% of cancer deaths, with five-year relative survival to be 33% from 2015-2021 as noted in SEER cancer [2] .

If articulating diagnosis of local brain stages it is 76.9% and other nervous system cancers [2]. Classification of stages has another figure based on facts as 77% localized, 14% regional , 2% distant and 1% unknown [2] .

Assessing the LMICs low and middle income countries, around 4.81 instances per 100,000 person , the high income countries have 6.29 instances annually [3]. Treatment can be failed as this is common in pediatric cases with brain tumor ranged from 37% to 83% in developing countries due to resource limitations [3] .

Well Artificial intelligence, AI has manifested a new role involving machine learning, transforming the whole medical field . For linguistic obstacle, aiding translation of medical reports into distinct folders avoiding inevitable human flaws in front of the patient's life [4] .

Powerful role of AI in oncological Neuro imaging , grading , segmentation, artificial neural networks ANNs which are inspired by human brains , have profound gains [5].

Researchers found Neuro quant software more reliable when measuring brain volume specifically Mild Cognitive Impairment [6].

The sole purpose of this article is to explain that diagnosing brain tumors can be complex as manual staging and detection has its own limits, where at the same time AI can take a bigger leap to go extents.

Methods: Study design and setting: This is a retrospective description that has observation of 10 different brain tumor patients from the Republican Hospital of Samarkand, 2025 outline.Meta synthesis of AI featured software Neuro Quant, with a whole foundation of global neurosurgeon years (2015-2025) is also used for comparison .

Data collection: The files of patients are obtained from Neurosurgery department of Republican Hospital, Samarkand State Medical University archives. For the cross analysis of algorithmic learning the neuro quant was considered as a better option [6]. Different metrics, demographics like age, tumor types, tumor in exact regions, symptoms, imaging characteristics, mass effect , edemas, cysts , histopathological results are carefully studied under all the cases. WHO, World Health Organization classification of CNS tumors (2021) is also taken into context for manually categorizing the grades of the study [7]. Patient's personal records are not identifiable and are well secluded.

Inclusion and Exclusion Criteria: The parameters for including datasets are 2025 brain tumor cases, clinical imaging following Magnetic Resonance Imaging, MRI and CT, Computed Tomography scans, histopathological results, time of onsets, motor and sensory symptoms, post and pre surgical symptoms, and other comorbidities. The exclusion factors involving genetic mutations, socioeconomic conditions and epidemic aspects.

AI thematic review: Utilizing Neuro quant into health system could significantly elevate the treatment plan and diagnosis by aiding in accurate segmentation, volumetric tumors, easy to read reports, fast PET results and providing faster results by valuing the criticality of time.

Data Analysis: Quantitative data aggregation is used as statistics (tables, graphs, images, percentages, numbers and mean values as shown in Image A, Image B, Image C). Qualitative sets include manual versus machine learning potential, available resources based on incomes and worldwide concern of neurosurgeons.

Results: Demographic and clinical profile:

In the collection of patient cases of brain tumors, there are 10% pediatric cases, 20% from age range (20-60) and 60% from age range (50-80).

If the symptoms are observed, headaches, dizziness and nausea is seen commonly (Figure 1.1), apart from that symptom like weakness or hemiparesis in limbs is noted due to location and spread of tumor or damage to corticospinal tract, frontal lobe and brain stem.

Post surgically due to disruption in brain, development of seizure were taken into context, hence anti-seizure medications were prescribed like carbamazepineas shown in Figure 1.3. Except for one patient 'F' who had seizure as symptom before the treatment.

Tumor type and diagnostic methods. As internationally meningioma are most commonly seen brain tumors, we have 60% meningioma cases, 20% gliomas, 10% adenoma and 10% craniopharyngioma.

Accounting on global scale in the year (2022), from Global Cancer Observatory, new cases, just in CNS cancers are 3,21,731 ranking 19th with 1.6% having 2,48,500 deaths, ranking 12th with 2.6%. When the worldwide cancer new cases are 1,99,76,499 with 97,43,832 deaths [8].

Re focusing on our cases, the diagnostic methods used in 95% records is Magnetic Resonance Imaging with 5% additionally using Computed Tomography (Figure 1.2).

Manual Stage classification. When this study was conducted each case minimally took 40 minutes to analyze the exact stage as per WHO classification system (2021) and maximum would just increase the time, excluding the time taken by MRI or CT machines.

Moreover, the histopathological results were noticed to be delayed, as recorded on that date, so it was an utter time lag, where as in parallel Neuro quant would be hardly 20 minutes excluding neurosurgeon's annotation [9] .

The major part of molecular data is also largely restricted in the reports.

Despite limitations, manual classification remained established standard for management as well as prognosis.

Global neurosurgery: So, as we have studied about LMICs with least resources and fewer neurosurgeons, it is barely possible to manage the brain cancers globally, hence Remote medical teams, centers, treatment plans are essential to improve diagnostic accuracy and have faster response to discriminating side of cancer.

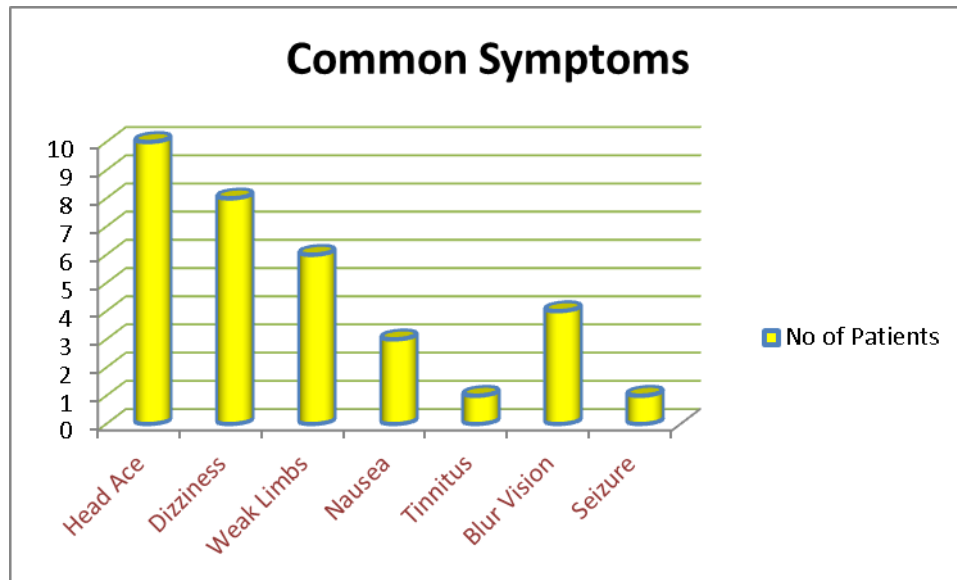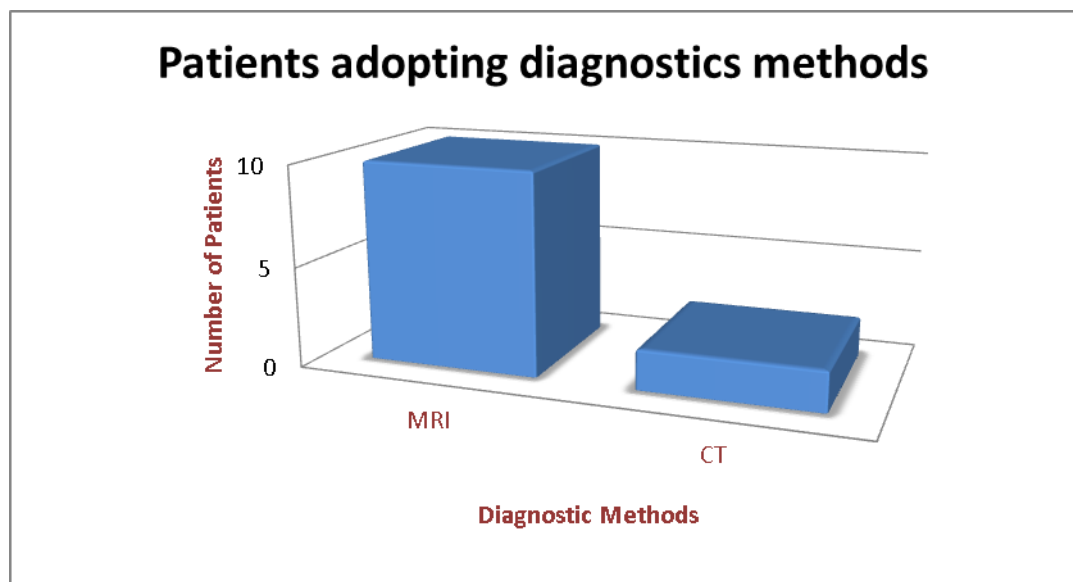| Patient	Brain Tumour Type	Grading of Brain Tumour as per the WHO classification system	Brain Tumour Region
A	Pilocytic Astrocytoma [Glioma]	I	In Medulla Oblongata extend to Cerebellum
B	Meningioma	I	In the right parietal parasagittal region
C	Meningioma	I	In the left frontal parietal region
D	Meningioma	I	In right parietal region
E	Meningothelial Meningioma	I	Left front temporal Medio basal brain region
F	Left petroclival Meningioma	II	In left Cerebellum bridge angle area
G	Transitional Meningioma	I	In the Cerebellopontine angle
H	Diffuse Astrocytoma [Glioma]	II	In the left frontal parietal region
I	Somatotroph Adenoma	1b	In the chiasmatic sellar region
j	Adamantinomatous Craniopharyngioma	I	In the chiasma-sellar area

Table 1

Figure 1.1
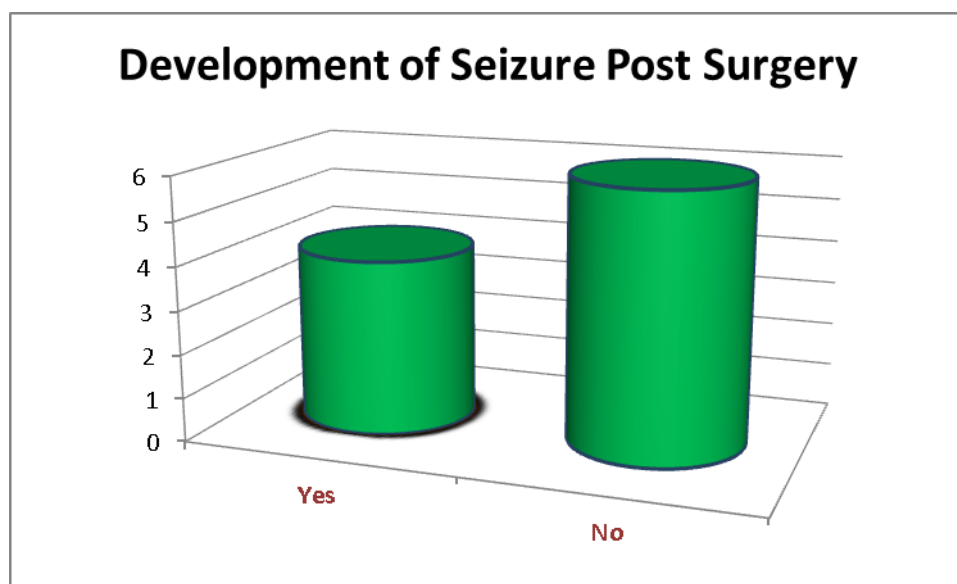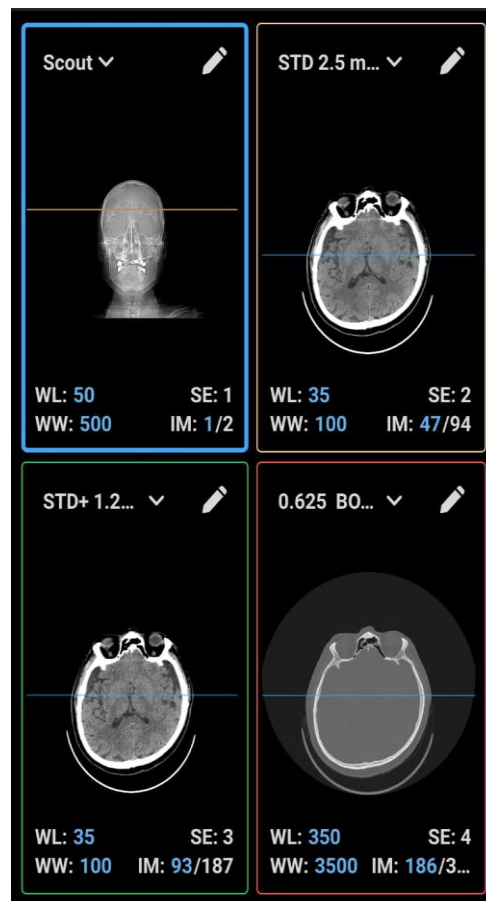
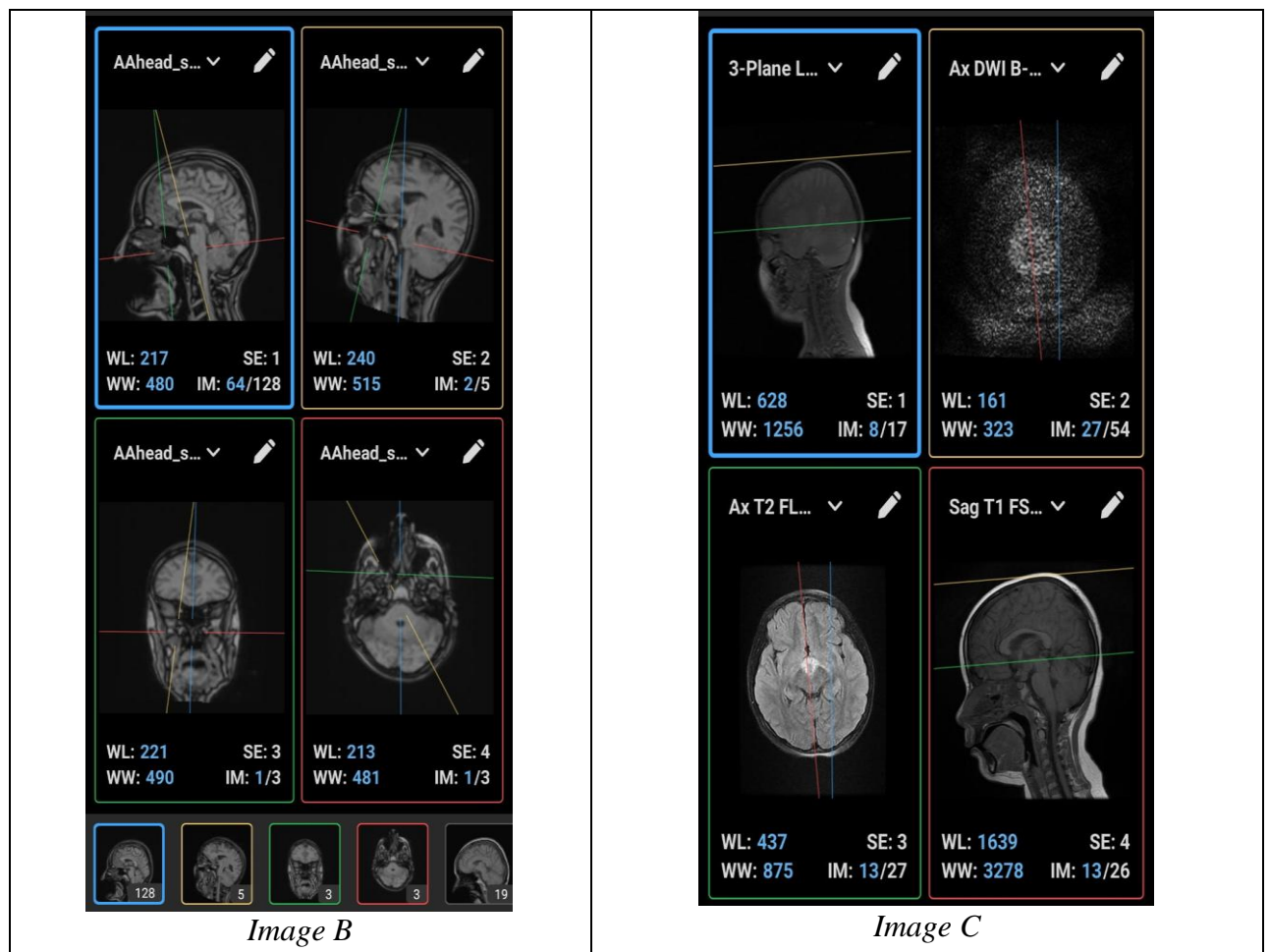

Figure 1.2

Figure 1.3

Image A

Image B

Image C

Principal finding: As seen in Table1, grading of tumor solely depend on histopathological results, and also the diagnostic report, where we had one of the unique case 'F' of petroclival meningioma being second grade, though WHO classified it under first, the reason is invasion of tumor in left cerebellar tissue which is a major criteria of grade two tumors, moreover it is also seen that tumor is compressing the tentorium cerebelli which has lead to decreased hearing in left ear hence in this study it is categorized under second grade. Where as another patient 'G' having meningioma in the same region of cerebellopontine angle is classified as transitional meningioma due to presence of homogeneous mass with intense contrast enhancement showing firm existence as well as calcification of tumor showing meningothelial properties.

Global equity. On the global scale , involvement of neurosurgeons in board meetings to fill the gaps and publicize the knowledge of healthy diet and stress management, while working on trying to find causes of brain tumors and establishing the AI technology into the medical field , is needed though the final call is the doctor's to make to keep the patient's out of danger, is significantly necessary.

Limitations: In this retrospective discussion, the study is dependent on completeness of data records, and it is extracted from single center, with no direct applications of AI, for only comparisons are made.

Future Implications: We should develop open access of AI tools for all the neurosurgeons, radiologist and pathologists globally.

Time efficiency could be made by integrating AI software directly into the MRI, CT machines, and getting early histopathological results .

Sharing networks universally to guide Neuro oncologists in controlling the brain tumors is important.

Conclusion: This study highlights manual staging if tumor that remains vital and it's limitations are inherent with emerging AI technologies, hence global health being the major impact .

As we found manual staging is done with lot of time consumption and AI could not only help with that but give better results though a cross correction is still needed to balance the cycle.

The data is completely legalized and is conducted under ethical standards of research keeping patients personal data anonymous and references are also clearly added wherever necessary.

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