and cystic components and significant perilesional edema and midline shift. On magnetic resonance imaging (MRI) scan, the lesion was hyperintense on T2 with central area of T1 hypointensity. The lesion demonstrated diffusion restriction with apparent diffusion coefficient (ADC), showed intense enhancement on contrast administration, and MR spectroscopy revealed choline peak. Overall, radiological impression was of a high‑grade glioma. Patient underwent craniotomy and excision of the lesion.

Histology [Figure 2] revealed a high‑grade neoplasm composed of sheets and single scattered cells with majority of them having cytoplasmic inclusions pushing the nucleus to the periphery, thus displaying signet ring cell morphology. At places, the cells had a gemistocytic look, but processes from the cells or a fibrillary background were not conspicuous. Cells displayed moderate pleomorphism. Focal necrosis was noted. There was no microvascular proliferation. No other pattern or native brain tissue was identified. Stain for mucin was negative.

Figure 1: (a) Pet – CT scan and (b) T1-MRI showing right parieto-temporal lesion with solid and cystic components with significant perilesional edema and midline shift
On immunohistochemistry, the cells were positive for glial fibrillary acidic protein (GFAP), vimentin, and S-100 protein. They showed p53 positivity, suggesting astrocytic lineage. They were negative for cytokeratin, epithelial membrane antigen (EMA), synaptophysin, and HMB-45. Ki-67 proliferating index was around 10%. This confirmed a diagnosis of a glioblastoma with unusual signet ring cell morphology.

O6-methylguanine-DNA methyltransferase (MGMT) promoter methylation was demonstrated in this case by polymerase chain reaction (PCR).

There were no deletions of 1p19q chromosome on fluorescence in situ hybridization (FISH).

**Discussion**

Glioblastoma (WHO Grade IV) is the most malignant primary brain neoplasm and is of astrocytic lineage. The prototype histology comprises poorly differentiated pleomorphic astrocytes with nuclear atypia and mitotic activity. Microvascular proliferation and/or necrosis are necessary for its diagnosis.\(^1\)

The presence of signet ring cells is very unusual in glioblastomas with only one previous case reported in literature till date.\(^2\) However, signet ring cells have earlier been described in primary CNS tumors like oligodendroglioma,\(^3\) ependymoma,\(^4\) primary CNS lymphoma,\(^5\) oligoastrocytoma,\(^6\) and astroblastoma.\(^7\)

This signet ring cell morphology can be confused with metastatic adenocarcinoma from the gastrointestinal tract. It is in these situations that immunohistochemistry is so useful to exactly delineate the cell of origin. Positivity for GFAP and negativity for cytokeratin confirmed glial origin of the signet ring cells. Furthermore, absence of 1p19q deletion and p53 positivity supported an astrocytic lineage of the tumor.

Rosenblum et al.\(^8\) reported four cases of lipid-rich epithelioid glioblastoma, but those had cells with centrally placed nuclei and multiple cytoplasmic lipid droplets which expressed cytokeratin, unlike our case which had typical signet ring cell morphology and was cytokeratin negative.

Martin et al. described a glioblastoma very similar to our case, which had sheets of signet ring cells with nuclear atypia, mitoses, extensive necrosis, and vascular proliferation. On immunohistochemistry, the cells were positive for GFAP and S100, and negative to cytokeratin. Electron microscopy revealed stacks of intermediate filaments, and FISH for 1p19q did not show any deletions.\(^2\)

Despite progress in surgery, radiotherapy, and chemotherapy of brain tumors, the overall survival of patients with glioblastoma remains extremely poor. Previous reports have shown a relative favorable prognosis for signet ring cell tumors of the CNS.\(^9,10\) Our patient expired within 5 months of symptoms and 3 months of diagnosis as was the case reported by Martin et al.

Due to the very few cases in literature, it remains to be seen whether signet ring cell glioblastoma is just a morphological variant or signifies a different carcinogenic pathway.

**References**

2. Martin SE, Bonnin JM, Hall DC, Hattab EM. Glioblastoma with


Source of Support: Nil, Conflict of Interest: None declared.