Glioblastoma Multiforme (GBM)
Presentation/Work-up:

- Age: 39, previously healthy.
- Neck pain, visual changes and headache over few weeks.
- MRI brain: 5x4 cm right temporal mass with a cystic component and associated hemorrhage, edema and a 1.5 cm midline shift.
• Surgery: Subtotal resection.
• Pathology: WHO IV, glioblastoma multiforme, MGMT negative.
• Postop MRI: residual enhancement measuring 1.2 cm in the posterior resection cavity.
• Exam: KPS 90
  Craniotomy scar, no neurological deficits.
Simulation:

• Contrasted Head CT.
• Supine, neck flexed.
• Face mask for immobilization.
Treatment Planning:

A- Fusion of planning CT with preop MRI:
- pre-op MRI axial T1 + Con

B- contouring:
GTV: post-op MRI axial T1 + Con*
CTV: GTV+ 2cm smart margin (off bones)
PTV: CTV +0.5 cm

Other Structures:
- Optic nerves
- Chiasm
- Temporal lobes
- Cochlea
- Lenses
- Brainstem
- Spinal cord
- Globes

* Per Stupp et al. (1,2)

* Alternatively: volumes per RTOG definitions:

GTV1: per T2 or the FLAIR abnormality postoperative MRI scan.
CTV1: GTV1+ 2cm
PTV1: CTV1+ 0.3-0.5 cm

GTV2/boost: contrast-enhanced T1 abnormality post-op
CTV2 : GTV +2 cm.
PTV2: CTV2+0.3-0.5 cm.
Rx: 46 Gy to PTV1 + 14 Gy boost to PTV2
### Prescription and dose constraints:

<table>
<thead>
<tr>
<th>Critical structure</th>
<th>Dose volume constraints</th>
<th>Maximum dose constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiasm</td>
<td></td>
<td>52 Gy</td>
</tr>
<tr>
<td>Chiasm PRV</td>
<td></td>
<td>54 Gy</td>
</tr>
<tr>
<td>Left optic nerve</td>
<td></td>
<td>52 Gy</td>
</tr>
<tr>
<td>Left optic nerve PRV</td>
<td></td>
<td>54 Gy</td>
</tr>
<tr>
<td>Left optic nerve</td>
<td></td>
<td>52 Gy</td>
</tr>
<tr>
<td>Right optic nerve PRV</td>
<td></td>
<td>54 Gy</td>
</tr>
<tr>
<td>Brainstem</td>
<td></td>
<td>56 Gy</td>
</tr>
<tr>
<td>Brainstem PRV</td>
<td></td>
<td>60 Gy</td>
</tr>
<tr>
<td>eyes</td>
<td></td>
<td>15 Gy</td>
</tr>
<tr>
<td>L/R Cochlea</td>
<td></td>
<td>30 Gy</td>
</tr>
<tr>
<td>L/R Cochlea PRV</td>
<td></td>
<td>35 Gy</td>
</tr>
<tr>
<td>GTV</td>
<td>≥100% coverage to a dose of at least 60 Gy; &gt;97% covered by 60 Gy</td>
<td>68 Gy</td>
</tr>
<tr>
<td>PTV</td>
<td>≥95% coverage to at least 60 Gy</td>
<td>68 Gy</td>
</tr>
</tbody>
</table>
Course

- Concurrent temozolomide at a dose of 75 mg/m2 per day.
- Nausea: Ondansetron.
- Weekly CBC and metabolic panel (watch for thrombocytopenia with TMZ).
- Right ear otitis.
- Follow up: four weeks after completion with repeat MRI.

References:


Hi Yield!

- Pseudoprogression: transient radiographic changes seen within first six months after finishing treatment, which represent exaggerated treatment response.
- MGMT: O6-methylguanine-methyltransferase, a DNA repair protein. MGMT promoter methylation is a favorable prognostic factor.
- **Stupp et al: RCT : XRT vs. XRT +TMZ (2,3):**
  - RT : 60 Gy in 30 fx.
  - Temozolomide : daily 75 mg/m2 with RT and 150-200 mg/m2 adjuvant first 5 days each month x 6 months.
  - Median OS : RT 12.1 mo vs. RT + TMZ 14.6 mo
  - MGMT methylation strongest survival prognostic factor: methylated 23.4 mo vs. unmethylated 12.6 mo.
  - Survival benefit of TMZ: seen across the board, regardless of MGMT status.