A Comprehensive Review of the Clinical Practise for treating SRS Patients at Nottingham University Hospitals NHS Trust

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Aim

In 2016 the East Midlands Brain Metastasis MDT was established. Since then, 316 patients have been treated with a total of 609 metastases. Audits looking at planning time and quality assurance (QA) time were performed, based on the number of Planning Target Volumes (PTVs) and their volumes. This included auditing conformity indices used for judging plan quality: R100% (RTOG CI), R50%, Target Coverage Ratio (TCR), Selectivity Index (SI), PaddickConformity Index (PCI) and Gradient Index (GI).

Methods

PLANNING AUDIT: An audit was carried out on 54 patients and 115 PTVs. The number of attempts to create a clinically acceptable plan and the total planning time was recorded against the number of PTVs in a plan as well as their volume.

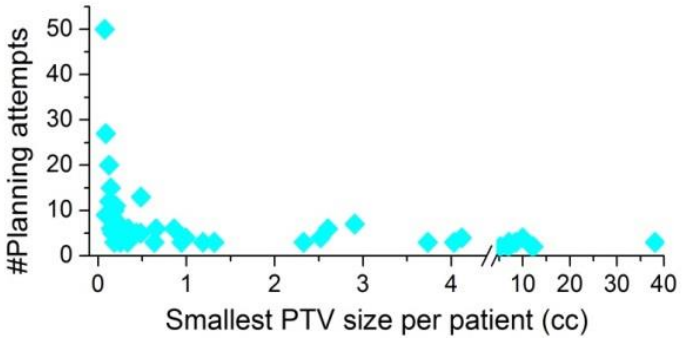
REVIEW OF CONFORMITY INDICES: Data from a total of 316 patients with 609PTVs were collated. The conformity indices for all patients were audited against PTV volume. Due to the large discrepancy between the numbers it was decided to introduce two sets of tolerances depending on whether the volume of the PTV was larger or smaller than 1cc. Definitions for the conformity indices are as below:

R100%	Body $V_{100\%}$(cc) /PTV Vol (cc)
R50%	Body$V_{50\%}$(cc) /PTV vol (cc)
TCR	PTV $V_{100\%(}$cc) /PTV Vol (cc)
SI	PTV $V_{100\%}$(cc) /Body $V_{100\%}$(cc)
PCI	Target Coverage *Selectivity
GI	Body $V_{50\%}$(cc) /Body $V_{100\%}$(cc)

QA AUDIT: About 30 min of linac time are required to carry out Patient Specific QA for each PTV. For patients with multiple PTVs the time required increases linearly with the increase in the number of PTVs. The audit reviewed 96 plans, with a total of 159 PTVs. Global gamma pass rate of 95% (5%, 2mm) with a cut-off of 20% was used. EBT-XD films in the sagittal or the coronal plane were used to measure a 2D dose distribution

Results

PLANNING AUDIT: The number of planning attempts and the planning time increased geometrically if a PTV was below 0.15cc. This was due to the fact that the optimisation was carried out using a 2 mm grid but the final plan was recalculated using a 1mm grid. For those small PTVs the dose would change significantly between the two calculations which led to additional planning time.



REVIEW OF CONFORMITY INDICES: Two sets of tolerances were set based on the volume of the PTV. The optimal and mandatory tolerance was calculated using the mean±SD and the mean±2SD respectively. There were 270 PTVs with a volume<1cc and 319 PTVs with a volume>1cc.

	PTV>1cc		PTV<1cc	
	Opt	Mand	Opt	Mand
R100%	1.12	1.19	1.54	1.78
R50%	4.12	4.87	12.19	16.01
TCR	0.94	0.93	0.93	0.89
SI	0.87	0.82	0.64	0.52
PCI	0.83	0.79	0.62	0.51
GI	3.82	4.42	8.28	10.27

QA AUDIT: The failures that were identified (gamma<95%) were assessed against the number of PTVs in a plan, the size of the PTV, the distance of the PTV from the plan isocentre and the dose/fx. No significant correlation was found between any of the above characteristics and PSQA failure. All failures seen could be attributed to human error, or issues with the film analysis. Due to this it was decided that the amount of PSQA could be reduced to only test 1PTV per plan.

Conclusion

- Separate tolerances for conformity indices were introduced depending on whether the volume of the PTV was smaller or larger than 1cc.
- Planners were given new guidance to plan PTVs smaller than 0.15cc in a separate plan to avoid delays.
- PSQA was reduced significantly and only 1PTV per plan is tested at the moment