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INTER-OBSERVER VARIABILITY IN CLINICAL TARGET VOLUME DEFINITION FOR GLIOBLASTOMA: PREOPERATIVE VERSUS POSTOPERATIVE MAGNETIC RESONANCE

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BACKGROUNDS

- The current standard of care for newly diagnosed glioblastoma (GBM) is maximal surgical debulking, followed by adjuvant radiation therapy (RT) and temozolomide chemotherapy.

Stupp R, et al. J Clin Oncol 2007;25:4127–36.

- Although RT has been a standard post-operative treatment for GBM for more than 25 years, it is under continuous investigation, and there are some controversies about the optimal way to deliver this therapy.

Buatti J, et al. J Neurooncol 2008;89: 313–37.

BACKGROUNDS

RADIATION TREATMENT VOLUME IS ONE OF THESE CONTROVERSIAL POINTS

There are several data showing that the natural history of GBM has a tendency for local recurrence, with complete resection being virtually impossible because of the infiltrative nature of this disease. More than 80% of recurrences occur within 2 cm of the original tumour margin, even after complete macroscopic resection.

Chan JL, et al. J Clin Oncol 2002;20:1635–42.
Aydin H, et al. Strahlenther Onkol 2001;177:424–31.
Chang EL, et al. Int J Radiat Oncol Biol Phys 2007;68:144–50.
Oppitz U, et al. Radiother Oncol 1999;53:53–7.

BACKGROUNDS

- These data support, in a generally accepted practice, that a uniform margin, of approximately 2.0 cm, is usually added to address clinically occult glioma cells and to create the clinical target

A 2 CM GTV EXPANSION IS CONSIDERED A GOOD COMPROMISE TO IRRADIATE ABOUT 85% OF TUMOUR CELLS AND TO SIMULTANEOUSLY SPARE HEALTHY TISSUES.

pre-operative examination or, alternatively, the cavity and residual enhancing lesion on post-operative images.

BACKGROUNDS

TO IDENTIFY THE OPTIMAL IMAGING APPROACH: what and when?

- In several trial protocols (e.g. the Radiation Therapy Oncology Group (RTOG) 0825 phase III trial and European Organization for Research and Treatment of Cancer (EORTC) 26082–22081), a different use of T1/T2MRI scans acquired pre or post-operatively has been suggested.

- Farce P. et al, have assessed the differences in volume and shape of the radiotherapy target comparing the use of pre-operative vs post-operative/pre-radiotherapy T1 and T2 weighted MRI.

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OUR EXPERIENCE

- We evaluated the impact of differences MRI sequences in CTV delineation.

- T1-gadolinium, Flair and Perfusional images, both in preoperative and in postoperative phase, were considered.

MATERIALS AND METHODS

- One patient with intracranial GBM was analyzed.
- For surgical planning and monitoring purposes, ***MRI 3 Tesla*** examinations were performed the day before surgery, and after the surgery before the beginning of adjuvant chemoradiation.
- Planning CT was acquired in supine position, using personalized termoplastic mask, slice CT 0,5 cm.
- MR images were transferred to treatment planning system, where they were matched together with planning CT using the available tools for image co-registration. Image registration was performed by an automatic mutual information algorithm.

MATERIALS AND METHODS

- Two radiation oncologist and a neuroradiologist were selected to delineate volumes.
- Four CTVs were delineated: pre- and post-operatively on T1 contrast enhanced images, and pre- and post-operatively on Flair images.
- In order to evaluate the impact of fMRI a further CTV was delineated post-operatively on the Perfusional images.

MATERIALS AND METHODS

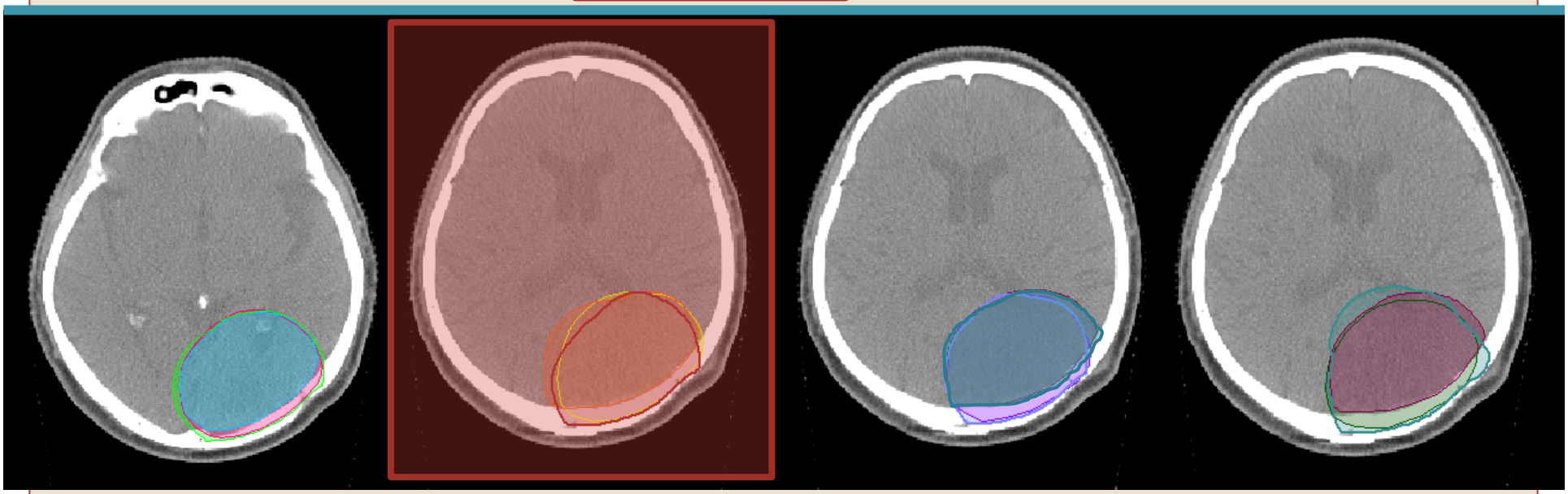
- To further compare two differently delineated CTVs (CTVI and CTVII), the overlapping volumes (CTVI > CTVII) and the composite volumes (CTVI < CTVII) were calculated by the treatment planning system, and a concordance index (CI) was defined as the ratio between the overlap and composite volumes.

$$CI = (CTV_I \cap CTV_{II})/(CTV_I \cup CTV_{II})$$

- CTVs were also compared in tems of: volume (in cc), diameters (anteroposterior, laterolateral and craniocaudal).

RESULTS: Volumes (cc)

	T1preCTV	T1postCTV	FlairpreCTV	FlairpostCTV
RADIATION ONCOGIST 1	72.7 cc	107 cc	85.4 cc	73.5 cc
RADIATION ONCOGIST 2	64 cc	104 cc	78.8 cc	84 cc
RADIOLOGIST	76.6 cc	72.3 cc	71.9 cc	80.8 cc



No significantly differences were observed.

But T1postCTVs resulted larger than volumes delineated by neuroradiologist (104 e 107 cc).

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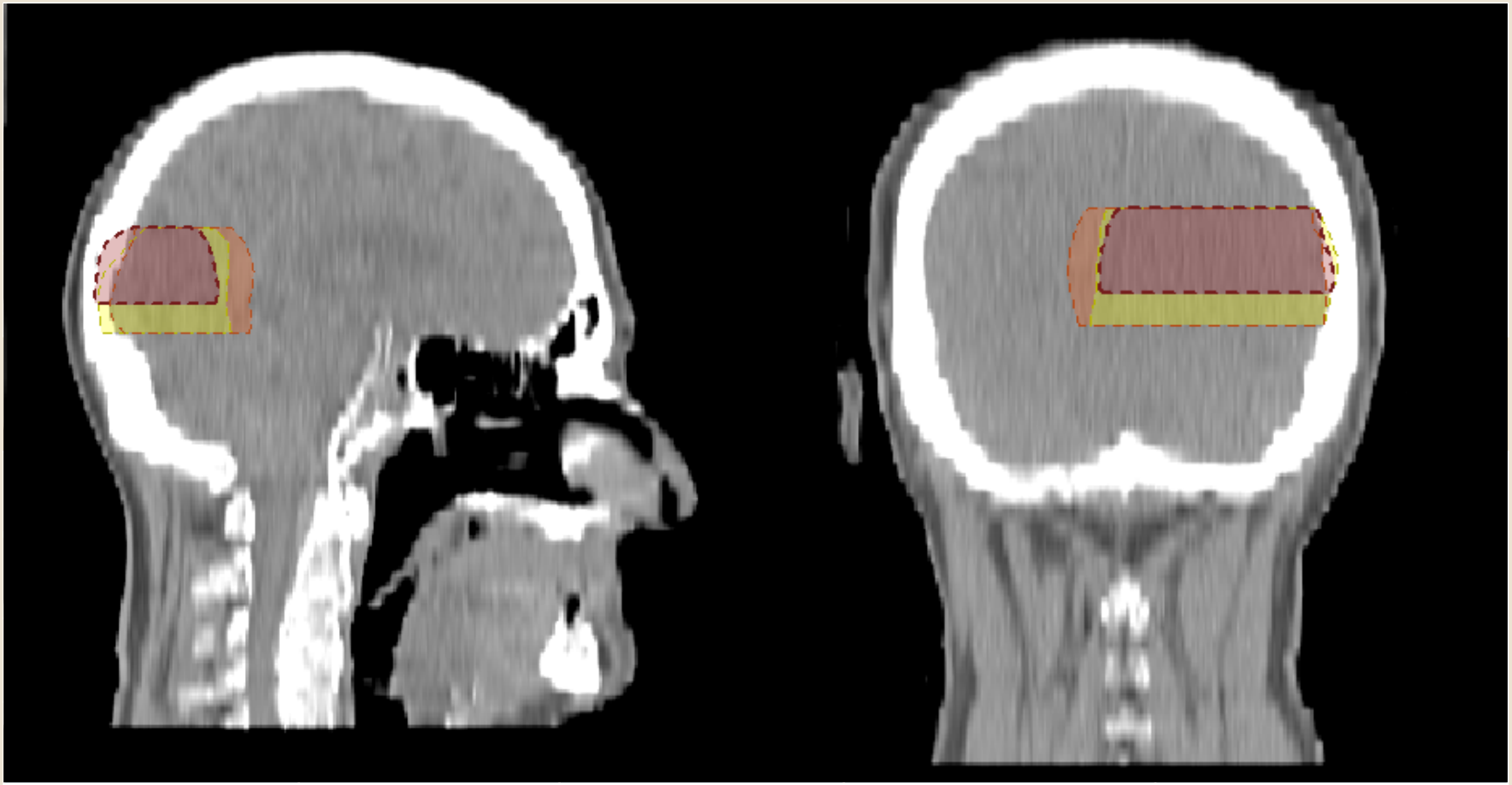
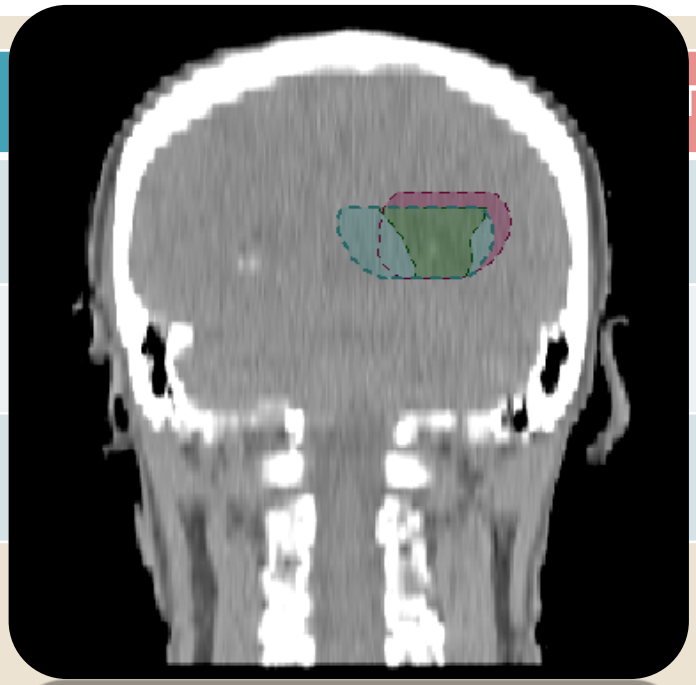
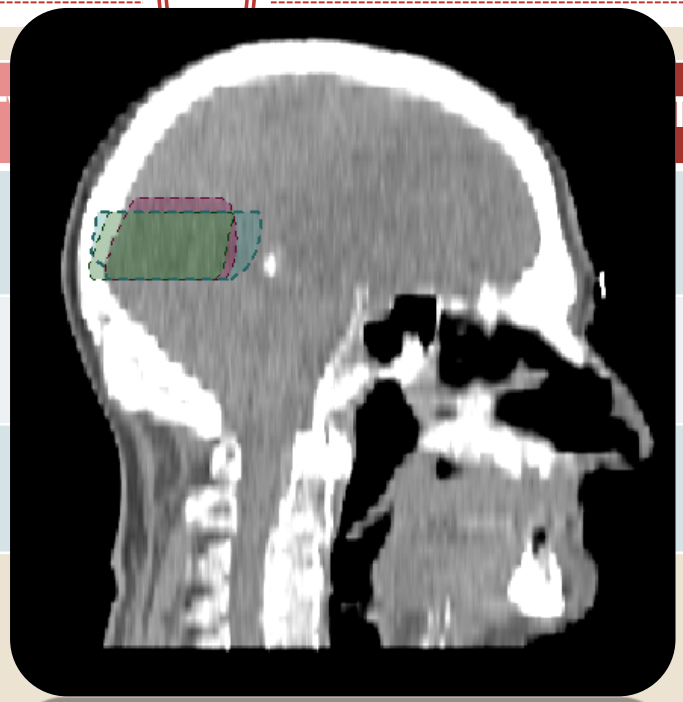
RESULTS: DIAMETERS

DRR images for CTv delineated on T1 postMRIs



RESULTS: CI (%)





TV	FlairpostCTV
	60%
	80%
	60%

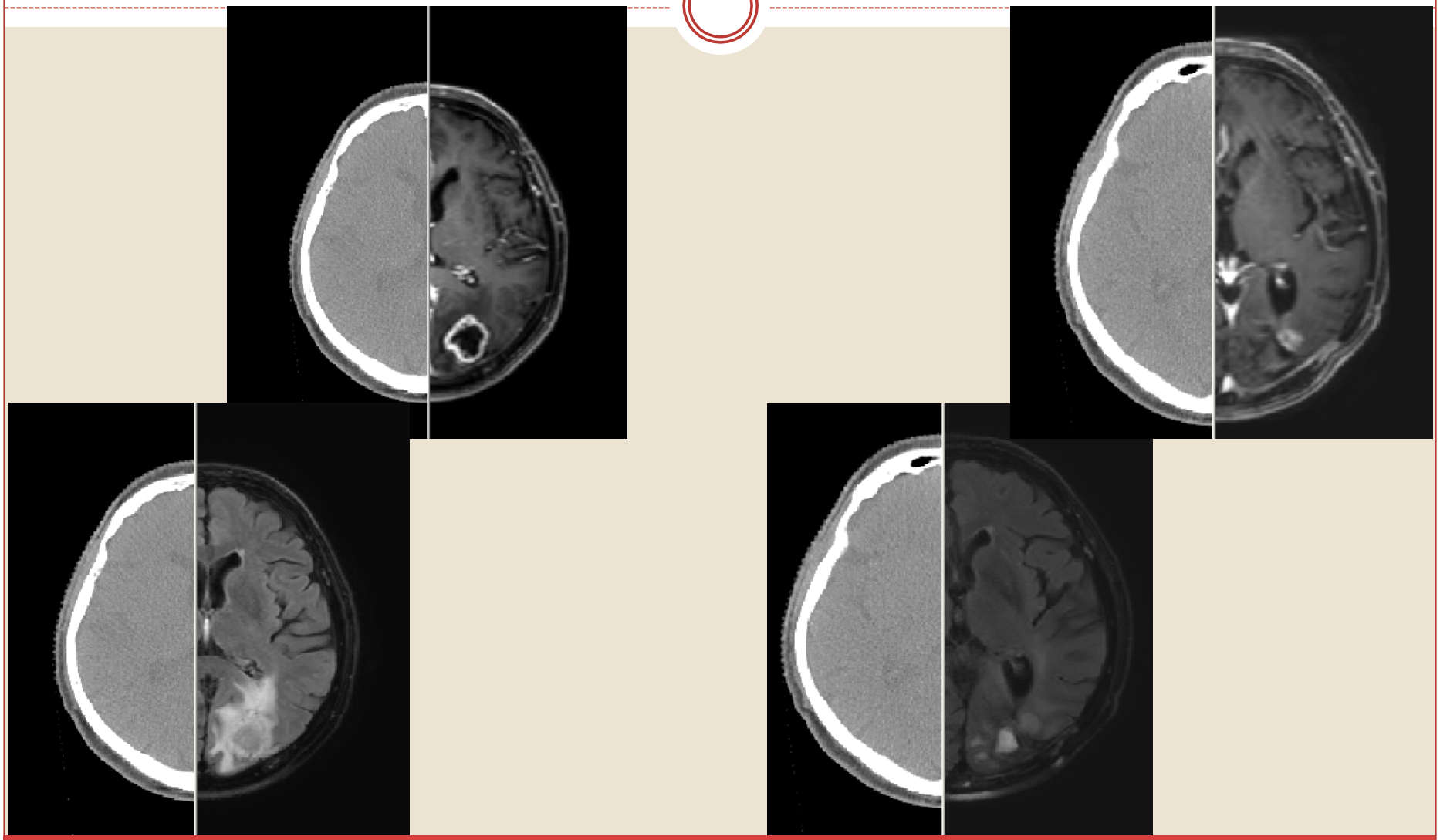
No significantly differences were observed.

Most important differences were observed for T1postCTVs.

FlairpostCTVs also differ sensibly.

Complexively postoperative seems difficult to interpretate.

What happens if perfusional MRI is associated to morphological resonance imaging and to planning CT ?



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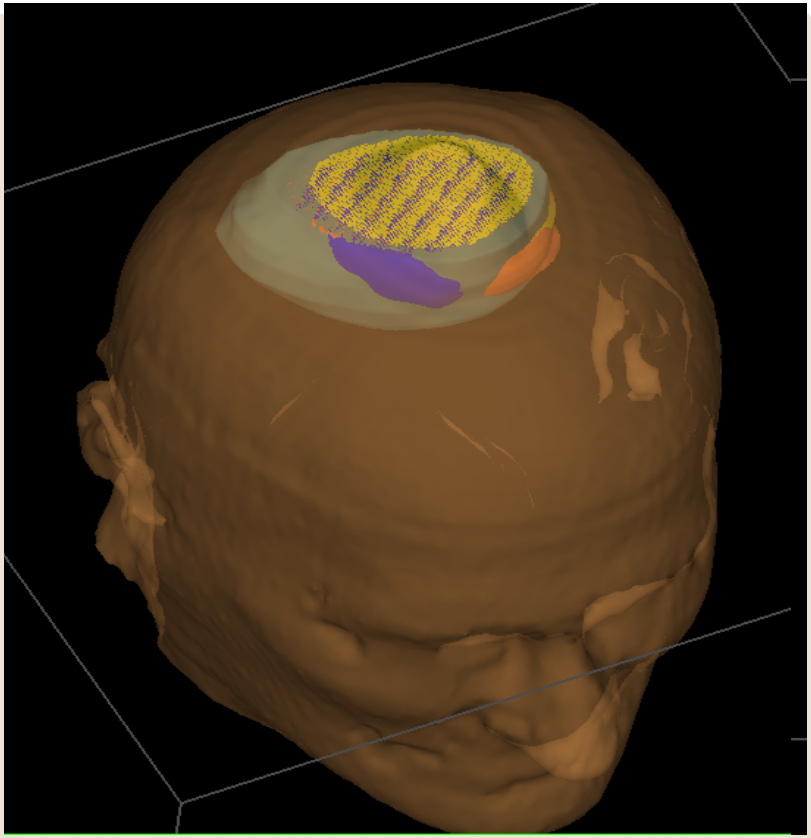
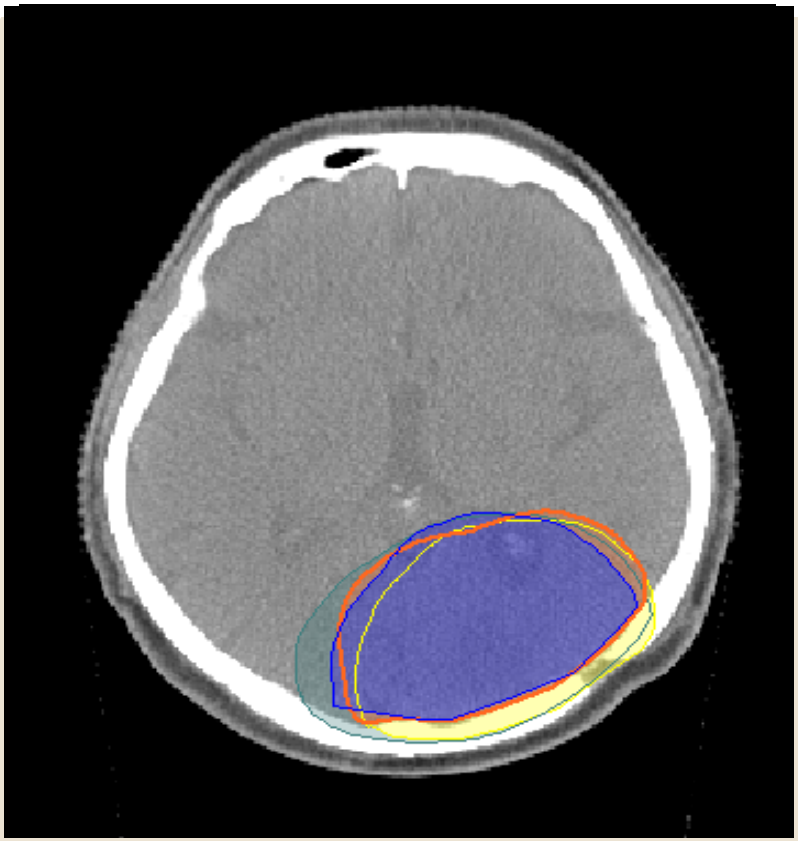
.....more voluminous CTV





Postoperative perfusional MRI

CONCLUSION

- Neuro-radiologist tends to surround volume smaller than the radiation oncologist on morphological MRIs.
- Postoperative imaging seems more difficult to interpretate.
- T1 or T2? We can not say which is better.
- Work in teams with the radiologist is essential:
  - Anatomical expertise;
  - Learning curve;
  - Rigorous methodology of image fusion.

- Perfusional imaging can be helpful, but its role needs to be better investigated (See poster 0129).

Grazie dell’attenzione