EPID 2D TRANSMISION IN VIVO DOSIMETRY:
Can it detect relevant anatomic and position differences in Lung SBRT?

N Jornet, P Carrasco De Fez, A Latorre-Mussoll, P Gallego, P Delgado, J Perea-Alija, M Ribas Morales

Servei de Radiofísica i Radioprotecció. Hospital de la Santa Creu i Sant Pau. Barcelona.

njornet@santpau.cat

HOSPITAL DE LA SANTA CREU I SANT PAU
UNIVERSITAT AUTÒNOMA DE BARCELONA

AIM

To study the sensitivity of a commercial 2D EPID transmission In Vivo Dosimetry (IVD) system to detect imposed anatomy and positioning differences under well controlled experimental conditions and in a series of SBRT-lung techniques.

MATERIAL AND PATIENTS

- TC BigBore (Philips)
- Clinac 2100CD (Varian)
- ARIA vs 13.5 (Varian)
- ECLIPSE (AAA calculation algorithm) (Varian)
- PerFraction vs 2.2.2.31209 (DoseCheck, 3D CBCT calculation EPID transit dosimetry)
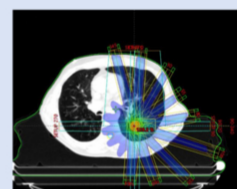
Phantom Study

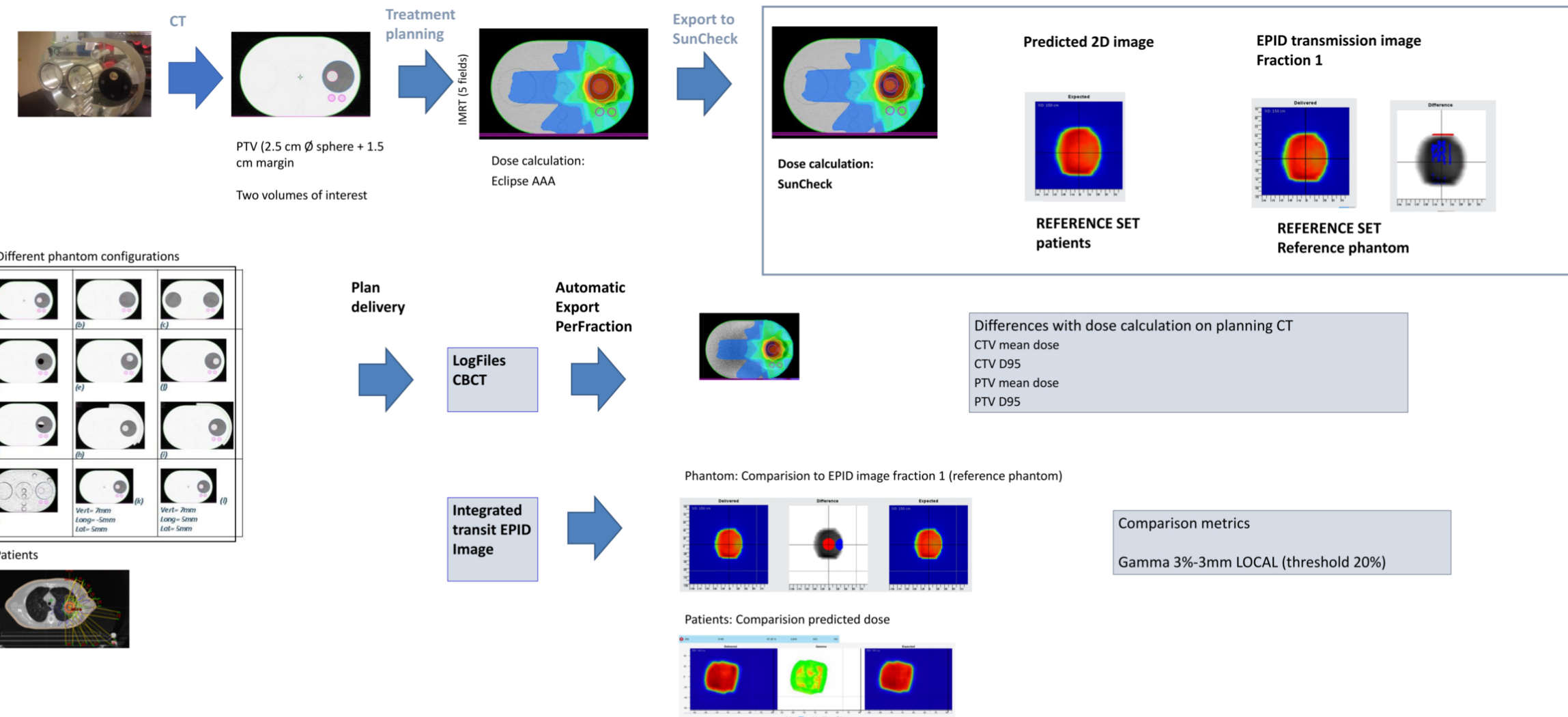QUASAR phantom (Modus Medical Devices Inc.)

Left: Lung insert with half pw sphere simulating the tumor
Right: Reference phantom configuration

Patient Study

10 CDRT SBRT lung patients

METHOD

CT
Treatment planning
IMRT (5 fields)
PTV (2.5 cm Ø sphere + 1.5 cm margin)
Two volumes of interest
Dose calculation: Eclipse AAA
Export to SunCheck
Dose calculation: SunCheck
Predicted 2D image
EPID transmission image Fraction 1
REFERENCE SET patients
REFERENCE SET Reference phantom

Different phantom configurations
Patients

Plan delivery
LogFiles CBCT
Automatic Export PerFraction
Integrated transit EPID Image

Differences with dose calculation on planning CT
CTV mean dose
CTV D95
PTV mean dose
PTV D95

Phantom: Comparision to EPID image fraction 1 (reference phantom)
Comparison metrics
Gamma 3%-3mm LOCAL (threshold 20%)

Patients: Comparision predicted dose

CONCLUSIONS

- For phantom studies: PerFraction module for 2D IVD sensitivity is excellent regardless of the technique, being capable to identify all the changes imposed on the phantom. However, the systematic shift from predicted to measured 2D dose has to be minimized in order to use predicted 2D dose as the reference.
- The sensitivity of the system to detect clinically relevant changes depends largely on the dose distribution with respect to the volumes of interest and changes. Increasing the distribution of beam portals increases this sensitivity.
- From the patients studies: No correlation is found between gamma pass rate and 3D CBCT dose recalculation. More work is needed to validate the dose recalculation using the CBCT.

RESULTS

- The sensitivity of the 2D in vivo method to anatomy changes field per field using gamma 3%-3mm G pass rate 95% was 81%, 97% and 80% for 3DCRT, IMRT and VMAT If the mean for all fields was used the sensitivity increased to 100% for 3DCRT and IMRT.
- No correlation is found for the 2D EPID in vivo method and the recalculation using the CBCT of the day. Worse results are found in the recalculation, probably due to inaccuracies in the dose recalculation using CBCT.
- Only 19% of the 2D EPID evaluations fail the gamma criteria of 90% of the points within 3%-3mm (local gamma), the dose recalculation shows differences larger than 11 % of those fractions.

gamma 3%-3mm G mean — 3DCRT
Gamma 3%-3mm G mean — IMRT
Gamma 3%-3mm G mean — VMAT
Patients: ITV mean dose differences

Each patient is represented with a different bullet color

ACKNOWLEDGEMENTS