QUALITY ASSURANCE PROCEDURE FOR SRS AND SRT TREATMENTS

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SRS / SRT TREATMENTS

- Introduced in 2009 at Riga East University Hospital.

- Equipment:
  - Novalis TX (Varian), Exactrac (Brainlab)

- Various localizations:
  - Head, liver etc.
CHALLENGES

☐ FRACTIONATED TREATMENT

1 - 5 GY PER FRACTION
10 - 39 FRACTIONS
CHALLENGES

☐ FRACTIONATED TREATMENT
CHALLENGES

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CHALLENGES

- FRACTIONATED TREATMENT
CHALLENGES

☐ FRACTIONATED TREATMENT

MISTREATMENT OF A SINGLE FRACTION DOES NOT HAVE SIGNIFICANT IMPACT ON DELIVERED DOSE
CHALLENGES

- RADIO-SURGERY

4 - 20 GY PER FRACTION
1 - 3 FRACTIONS
CHALLENGES

☐ RADIO-SURGERY
MISTREATMENT IN A SINGLE FRACTION HAS SIGNIFICANT IMPACT ON ALL THE TREATMENT
TREATMENT ACCURACY

SRS / SRT REQUIRES HIGHER QUALITY IN TERMS OF TREATMENT DELIVERY
TREATMENT ACCURACY

SRS / SRT REQUIRES EXTENDED QUALITY ASSURANCE PROCEDURE
CAUSES OF INACCURACY

- Patient Positioning
- Misconfiguration of TPS
- Software Bugs
- Mechanical Faults of Treatment Delivery System
- Mis-calibration of LINAC
- Ionization Chambers
- Mechanical Indicators
POSITION UNCERTAINTIES

- EXACTRAC (BRAINLAB)
QUALITY ASSURANCE

HARDWARE RELATED

PATIENT RELATED
PATIENT-RELATED QA FOR SRS/SRT

- Dose Plane Measurement
- Absolute Point-Dose Measurement
- Winston-Lutz Test
DOSE PLANE MEASUREMENT

1. CALCULATION OF TREATMENT PLAN ON QA PHANTOM
2. MEASUREMENT WITH RADIOCHROMIC FILM
3. COMPARISON OF MEASURED DOSE VS CALCULATED
FILM DOSIMETRY

- GAFCHROMIC EBT2 (ISP) FILMS
- DOSE RANGE UP TO 40 Gy
- CALIBRATION: TEST FILM WITH KNOWN DOSE
- METHOD: COMPOSITE ANALYSIS
ANALYSIS:

GAMMA INDEX - 1MM / 5% / SUPPRESS < 5%

ACCEPTABLE: GAMMA PASS > 90%

UNACCEPTABLE: GAMMA PASS < 85%

MEAN 96.4 ± 2.6 %
PATIENT-RELATED QA FOR SRS/SRT

- DOSE PLANE MEASUREMENT
- ABSOLUTE POINT-DOSE MEASUREMENT
- WINSTON-LUTZ TEST
POINT DOSE MEASUREMENT

1. CALCULATION OF TREATMENT PLAN ON QA PHANTOM
2. MEASUREMENT WITH IONIZATION CHAMBER
3. COMPARISON OF MEASURED DOSE VS CALCULATED
POINT DOSE MEASUREMENT

- Hand-Made Phantom
- Pinpoint Chamber (PTW)
- 0.016 cm³

Analysis:
Local difference in %
Acceptable < 3%
Unacceptable > 5%

Mean -1.2 ± 1.6 %
PATIENT-RELATED QA FOR SRS/SRT

- DOSE PLANE MEASUREMENT
- ABSOLUTE POINT-DOSE MEASUREMENT
- WINSTON-LUTZ TEST
WINSTON-LUTZ TEST

1. Align pointer to isocentre
2. Take portal images from necessary angles
3. Determine centre of field
4. Determine centre of pointer sphere
5. Determine the distance between centers
WINSTON-LUTZ TEST

ACCEPTABLE < 1MM
UNACCEPTABLE > 1MM

Sphere size, mm
PATIENT-RELATED QA FOR SRS/SRT

- Dose plane measurement
- Absolute point-dose measurement
- Winston-Lutz test
CONCLUSIONS

- The developed patient related QA procedure is sufficient to verify accuracy of treatment planning system calculations, precision of treatment delivery mechanics and system in general.

- Additional machine related verifications are necessary.

- QA program, based on described principles, has been implemented in Riga East University Hospital.
THANK YOU!

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