Remote Audits to GammaKnife
IROC

Paola Alvarez
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No conflict of interest to declare

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IROC Houston QA office
UT MD Anderson Cancer Center

Texas Medical Center
Houston - Texas
Extent of Activities

• **1,877** RT sites participate in NCTN
• **439** other RT sites (primarily international)
• **53** countries
Core services

- **Site Qualification:** Output checks
- **Trial Design Support:** Review protocols
- **Credentialing:** Phantoms, IGRT, benchmark cases....
- **Data Management (pre-review):** Prepare patient cases for review
- **Case Review:** Review patient cases to ensure they follow the protocol
- **Data Management (post-review):** Store/manage reviewed data
GammaKnife data since 1996
Records from our database
159 institution with at least one GK unit
140/159 are in USA
Models: number of units as May 2021
Elekta GK 4,4C,C: 77 / 17 active
Elekta Perfexion: 74 / 57 active
Elekta ICON: 60 / 58 active
MASEP Infini: 2
American Radiosurgery Vertex 360: 1
Output check - phantoms

GammaKnife Cassette

Solid water sphere

ABS plastic sphere

GammaKnife Insert
Output check

Detector: TLD LiF-100 powder in capsules

Dose: 6 Gy to the center of the phantom

Criteria: TLD dose/Delivered dose within 5%

1st report issued: February 2008
Output check – since 2008

Average: 0.999 +/- 0.020
Total results: 976
Output check - results 2020

Average: 1.000 +/- 0.018
Total results: 95
Output check

Some numbers

Values over history (on 2020)

Report dose to muscle: 13% (11%)
Calibration protocol TG 21: 68% (57%)
Output check

Percentage of results reported per year

- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020

TG21
TG51
TG178
TRS398
TRS483
Other
Anthropomorphic Phantom

Head / SRS treatment / centrally located target 1.9cm diameter

Original design
Fill up with water / two inserts
TLD, sagittal and coronal films

New design
Solid head / one inserts
TLD, sagittal and coronal films
Anthropomorphic Phantom

MRI and CT planning image

Dose center of target: 30 Gy

Coverage of target with 15 Gy isodose line

Use IGRT
Anthropomorphic Phantom

Detectors: TLD LiF-100 powder in capsules
Gafchromic Film (MD55/MDV3)

Dose: 30 Gy to the center of the target

Criteria: TLD dose/Delivered dose within 5%
At least 85% of pixel within 5%/3mm per plane

1st report issued: June 1996
Anthropomorphic Phantom

![Graphs showing dose profiles for different directions: Left-Right Profile and Superior-Inferior Profile.](image)

*Film* and *Institution Values* are indicated on the graphs.
Anthropomorphic Phantom

Film dose

TPS dose
Anthropomorphic Phantom

Gamma Analysis
Anthropomorphic Phantom

Some numbers

GK(other deliveries) period 2012-2020

Number report: 130 (942)
Pass rate: 89.2% (84.6%)
Anthropomorphic Phantom

Some numbers

GK(other deliveries) period 2012-2020

Failure due to TLD dose: 93% cases (68% cases)

Avg. TLD/Inst dose: 0.985 ± 0.026 (0.982 ± 0.036)

Available under MD Anderson Phantom Lab (Fee)
Summary

More than 25 years offering QA audits to GK

Results are consistent over time

Dose from plans is reported to water (see TG 329)

Reference calibration is combination of standards
Thank you

irochouston.mdanderson.org