

# Quality Assurance for High Dose Rate Remote Afterloaders

Mark J. Rivard and Christopher S. Melhus

Tufts-New England Medical Center, Boston, MA



# HISTORY

HDR RALs used since 1960s for  $^{60}\text{Co}$ ,  $^{137}\text{Cs}$ ,  $^{252}\text{Cf}$ , and  $^{192}\text{Ir}$  (current pursuit of  $^{169}\text{Yb}$  & electronic sources)

new medical devices require new QA standards

AAPM TG-41 (1993) first protocol to assess HDR QA

AAPM TG-56 (1997) for general brachytherapy QA

AAPM TG-59 (1998) specific to HDR QA

# HDR ADVANTAGES AND QA ETHICS

HDR brachytherapy advantages compared to LDR  
ability to provide quick treatments  
computer controlled source positioning  
clinical outcomes  $\geq$  LDR  
decreased radiation exposure to staff  
record and verify of intended treatment  
higher financial reimbursement

With additional system complexities, how could you ethically proceed without regularly performing QA?

# HDR PROCESS OVERVIEW

licensing and installation

acceptance testing and commissioning

staff training and emergency procedures

QA of RTP and imaging systems

new source QA

monthly QA

daily QA

patient treatment QA

weekly CMPC

annual radiation safety audit of treated patients

# licensing and installation

need close collaboration with RSO and management to coordinate construction and purchasing

assure appropriate physicist FTE is allotted for HDR

ask vendor to provide contacts at other institutions willing to guide your effort

physicist should be present during RAL installation

topic further discussed this week by Glenn Glasgow:

Regulatory Aspects      Monday

Facility Design          Friday

# acceptance testing and commissioning

manufacturer-specific acceptance testing procedures (ATPs) similar in spirit to linac, but of smaller scope

a thorough New Source (Quarterly) QA procedure will cover aspects needed for initial HDR RAL use

however, detailed assessment of peripheral (RTP, imaging, etc.) system performance is required

commissioning discussed thoroughly in Gary Ezzell's chapter 28 from 1993 AAPM Summer School text

# staff training

new 10 CFR Part 35 outlines regulatory requirements for RSO and medical physicist training

physicist / MD board-certification is not a free-ticket to start / join an HDR brachytherapy program

initial training may be obtained at established sites using HDR, or through manufacturer-provided seminars specific to the new HDR RAL

physicist responsible for on-going training program for new MDs, physicist, therapists

# staff training

provide hands-on opportunity to gain experience treating a variety of patients without repetition

review perspective of all involved parties, and review HDR license, QMP, and QA procedures

provide a comprehensive exam with a fixed pass rate and supplemental action in case of failure

document all training, and set them free

annual training on emergency procedures and QMP review is required and should be documented

# emergency procedures

review emergency procedures annually, and consider well-planned “surprise” to truly test staff preparedness

physicist should calmly lead the process

verbally delegate tasks such as contacting HP and getting additional assistance (e.g., nursing)

always have in hand the survey meter, everyone should don badges

towards ALARA, distance and time are most important towards minimizing staff exposure

# emergency procedures



keep lid open, push emergency off button, practice turning the correct crank, keep your cool

# emergency procedures



assure all ancillary tools and devices are available and in good working order preceding every treatment

# QA of RTP and imaging systems

confirm correct data entry in RTP, and perform hand calculations to test algorithm and digitizer interface

develop an atlas of treatment plans for a specific type of brachytherapy implant (e.g., vaginal cylinder)

optimize imaging capabilities during off-hours

topic further discussed in talks this week:

Localization I	Lief	(Tuesday)
Localization II	Rownd	(Tuesday)
RTP QA	Li	(Wednesday)

# new source QA

HDR  $^{192}\text{Ir}$  source exchange typically performed every three months in the US.

coordinate with vendor to comply within institutional licensing limits: typically max. of 2 sources and 22 Ci

survey vault & RAL upon new source exchange, document results, compare with specified tolerances

AAPM TG-56 recommends QA and documentation of device-related equipment (caths, applicators, dummy wires) every 3 months

# new source QA

autoradiograph to assess source isotropy and congruence with dummy marker positioning

check RAL timer accuracy, linearity, transit time

measure source strength for comparison with manufacturer-supplied calibration

always set tolerances and document all results

update RTP and control console with new  $S_K$ , and printout new decay tables

# monthly QA

typically not performed due to new regulations, but may not be adopted by agreement states - be patient

physicist should perform monthly QA within 31 days of a patient treatment

check source strength constancy, RAL performance, agreement with RTP system

# daily QA

AAPM TG-56 provides specific guidance

performed by either a therapist or physicist

checks of AV system, radiation area monitor, survey meter, emergency tools, control console, printout accuracy, emergency button functionality, etc.

required tests are mundane, but typically < 1 hour

good to rotate staff to assure up-to-date training

# patient treatment QA

checklist for guiding staff through treatment

responsibilities assigned towards smooth operations and comprehensive documentation

RTT checks bailout pig, Rx, consent form, patient ID, TxP approvals, field checks

physicist surveys patient, checks connections

require RTT/MD/physicist all to be within earshot during treatment delivery in case of emergency

# patient treatment QA

physicist surveys patient before and after treatment

physicist surveys RAL before and after treatment

document survey results in Tx delivery logbook

Quality Management audit immediately after treatment to assure all documentation is complete

inventory equipment/supplies in case of surprise case

# weekly CMPC

review all patient treatment documentation, document findings in patient chart, and charge 77336

n=2 77336 charges if  $\geq 8$  fractions, else n=1 77336  
do not overbill if patient receiving concurrent XRT

weekly QA may be overlooked since patient may not be treated on linac and not on departmental schedule

perform EOT review after MD EOT note entry

# annual radiation safety audit

annually audit 10% of charts for a given modality (HDR, IVBT, etc.) for QMP compliance

if problems are evident, review 100% of charts for QMP compliance

document results for RSC review

RSO annually reviews QMP to assure program is current and accurate

physicist assists by informing of pertinent changes, possibly performed during manufacturer PMI

# Summary

HDR RAL QA and QMP are key towards minimizing misadventures and maximizing quality deliver of brachytherapy