

Electronic Charting for Brachytherapy

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Introduction

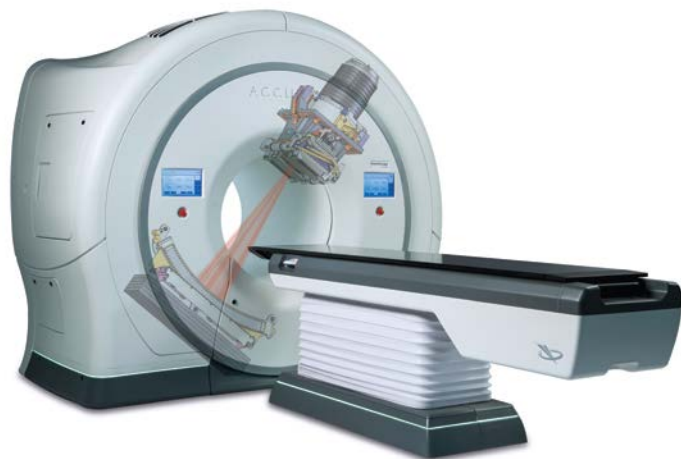
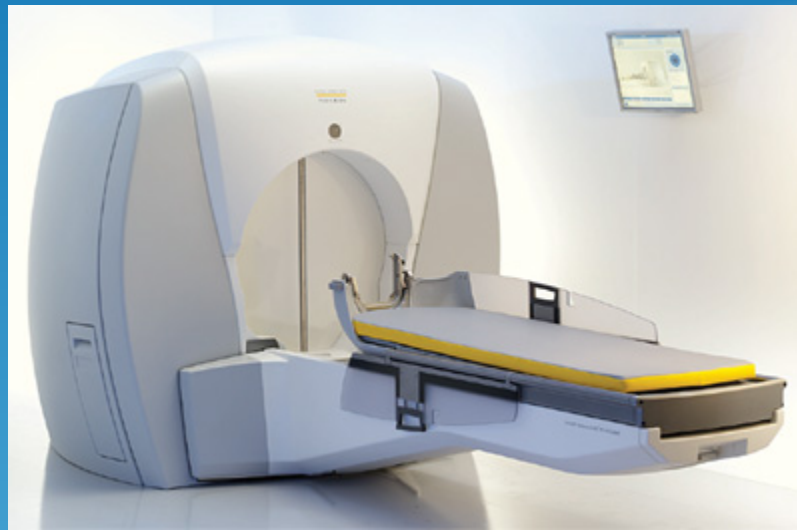
- ❖ No published literature
- ❖ Clinical experience (myself/Susan Richardson)
 - Nucletron/Impaq (2002-2007)
 - Verisource/ARIA (2007-2012)
 - GammaMed/MOSAIQ (2012-present)
- ❖ Input from TG-262 (EMR) questionnaire, discussion, early drafts

Why is Brachy not like a LINAC?

- ❖ EMR is not the R&V
- ❖ Range of connectivity from none to some
- ❖ Legal constraints set by NRC (in the USA, in agreement states)
- ❖ For LDR: location of procedure in OR

But wait – does this not sound familiar?

Many other devices are like brachy!



Replace Brachy/External Beam With These Categories:

❖ **No** connectivity

- LDR in OR
- Some HDR/EMR combinations
- Other devices without EMR connectivity software

❖ **Limited** connectivity

- Some HDR/EMR combinations
- Other devices with (optional) EMR connectivity software

❖ **Full** connectivity

- (possibly) ARIA/Verisource

**Before we study these
categories, let's cover the
Written Directive first**



10 CFR 35.40 Written Directives



- ❖ (a) A written directive must be dated and signed by an authorized user before the administration of I-131 sodium iodide greater than 1.11 megabecquerels (MBq) (30 microcuries (μCi)), any therapeutic dosage of unsealed byproduct material or any therapeutic dose of radiation from byproduct material.
 - **Should Not Be Necessary to use in RadOnc**
- ❖ (b) The written directive must contain the patient or human research subject's name and the following information-
 - (1) For any administration of quantities greater than 1.11 MBq (30 μCi) of sodium iodide I-131: the dosage;
 - (2) For an administration of a therapeutic dosage of unsealed byproduct material other than sodium iodide I-131: the radioactive drug, dosage, and route of administration;
 - (3) For gamma stereotactic radiosurgery: the total dose, treatment site, and values for the target coordinate settings per treatment for each anatomically distinct treatment site;
 - (4) For teletherapy: the total dose, dose per fraction, number of fractions, and treatment site;
 - (5) For high dose-rate remote afterloading brachytherapy: the radionuclide, treatment site, dose per fraction, number of fractions, and total dose; or
 - (6) For all other brachytherapy, including low, medium, and pulsed dose rate remote afterloaders:
 - (i) Before implantation: treatment site, the radionuclide, and dose; and
 - (ii) After implantation but before completion of the procedure: the radionuclide, treatment site, number of sources, and total source strength and exposure time (or the total dose).
- ❖ (c) A written revision to an existing written directive may be made if the revision is dated and signed by an authorized user before the administration of the dosage of unsealed byproduct material, the brachytherapy dose, the gamma stereotactic radiosurgery dose, the teletherapy dose, or the next fractional dose.
 - (1) If, because of the patient's condition, a delay in order to provide a written revision to an existing written directive would jeopardize the patient's health, an oral revision to an existing written directive is acceptable. The oral revision must be documented as soon as possible in the patient's record. A revised written directive must be signed by the authorized user within 48 hours of the oral revision.
- ❖ (d) The licensee shall retain a copy of the written directive in accordance with § 35.2040.

10 CFR 35.40 Written Directives



- ❖ (a) A written directive must be dated and signed by an authorized user before the administration [...]
- ❖ (b) The written directive must contain the patient or human research subject's name and the following information-
 - [...]
 - (3) For gamma stereotactic radiosurgery: the total dose, treatment site, and values for the target coordinate settings per treatment for each anatomically distinct treatment site;
 - (4) For teletherapy: the total dose, dose per fraction, number of fractions, and treatment site;
 - (5) For high dose-rate remote afterloading brachytherapy: the radionuclide, treatment site, dose per fraction, number of fractions, and total dose; or
 - (6) For all other brachytherapy, including low, medium, and pulsed dose rate remote afterloaders:
 - (i) Before implantation: treatment site, the radionuclide, and dose; and
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- ❖ (c) A written revision to an existing written directive may be made [...]

Written Directive for HDR

Radiation Prescriptions
Name, MR #

Dx: IIIB: *Endocervix
Course: 1

» Site	Technique	Modality	Fractions				Rx D	
			Act	Rx	Dose	Pattern	Act	Rx
Rt inguinal bst 2	ENFACE ELECT	12e	5	5	200 cGy	Daily	1,000 cGy	1,000 cGy
Lt inguinal bst 2	ENFACE ELECT	12e	5	5	200 cGy	Daily	1,000 cGy	1,000 cGy
cervix1	HDR Interstitial	Ir-192 HDR	2	2	700 cGy	Daily	1,400 cGy	1,400 cGy
Cervix2	HDR Interstitial	Ir-192 HDR	2	2	700 cGy	Daily	1,400 cGy	1,400 cGy

Rx Site: cervix1
Status: Approved JSM 11/17/2015
View Fractions: By Course
Number Fractions: By Course

Technique: HDR Interstitial
Modality: Ir-192 HDR
Dose Spec: EFF POC1

Start this Site 1 day(s) after fraction 5 of Site Lt inguinal bst 2

Rx Dose	Fractional Dose	Number of Fractions	Fractionation Pattern	Status
1,400 cGy	700 cGy	2	Daily	Fractions Treated

Week	S	M	T	W	T	F	S
1		1	2	3	4	5	
2		6	7	8	9	10	
3		11	12	13	14	15	
4		16	17	18	19	20	
5		21	22	23	24	25	
6		+26	+27	+28	+29	+30	
7		+31	+32	+33	34	35	
8		36	37				

Dose Limits
Total Cum:

Pattern: tandem, cylinder, 5 250mm, 4 320mm
Comment: 30cc bladder

Close
Add
Change
Delete
Dosimetry
Note
Plan Docs
Status
Fx Notes

Radiation Rx is View Only

Written Directive for LDR

- ❖ Pre-Planning/Pre-loaded Needles:
 - Pre-Implant handled like HDR
 - Post-implant component done in OR
- ❖ Live (in-OR planning): EMR Rx for Nomogram

Radiation Prescriptions - MR#:

Dx: 0 - Not paired *Prostate Gland Gleason 3+4= 7
Adenocarcinoma, NOS

Course: 1

Site	Technique	Modality	Act	Rx	Dose	Pattern	Act	Rx
Prostate	LDR Brachythera	I-125	1	1	14,500 cGy	Daily	14,500 cGy	14,500 cGy

Rx Site: Prostate
Technique: LDR Brachytherapy
Modality: I-125
Dose Spec: min D80%

Status: Approved RKV 10/12/2015
View Fractions: By Course
Number Fractions: By Course

Rx Dose	Fractional Dose	Number of Fractions	Fractionation Pattern	Status
14,500 cGy	14,500 cGy	1	Daily	Fractions Treated

Week 1: S M T W T F S (M is highlighted with 1)

Dose Limits: Total Cum:

Pattern: Special Physics Consult
Comment: Prior RT at OSH for H&N cancer

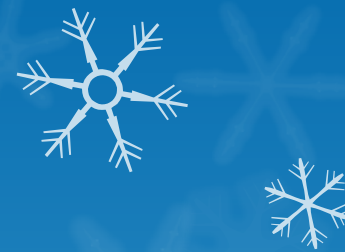
Radiation Rx is View Only

Buttons: Close, Add, Change, Delete, Dosimetry, Note, Plan Dgcs, Status, Fx Notes

Written Directive for live plan LDR: Paper Written Directive Used in OR

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"><p>MR#: <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/></p><p>Name of Patient: _____</p><p>Date of Birth: _____</p><p style="text-align: center;">Place Label Here</p></div>	<p>UNIVERSITY OF CALIFORNIA, DAVIS MEDICAL CENTER SACRAMENTO, CALIFORNIA</p>
<p>University of California Davis Health System Department of Radiation Oncology Permanent Prostate Seed Implant Written Directive</p>	
<p>Pre-implantation:</p> <p>Treatment Site: <u>Prostate + margin (≤ 5 mm)</u></p> <p>Intended number of I-125 seeds: _____</p> <p>Prescribed Dose (mCi): _____</p> <p>Treatment Time: <u>Permanent</u></p> <p>Date: _____</p> <p>AU Signature: _____</p> <p>AU Name: <u>Richard Valicenti, M.D.</u></p> <p>Post Implantation before completion of procedure:</p> <p>Treatment Site: <u>Prostate + margin (≤ 5 mm)</u></p> <p>Number of I-125 seeds implanted: _____</p> <p>Delivered Dose (mCi): _____</p> <p>Treatment Time: <u>Permanent</u></p> <p>Date: _____</p> <p>AU Signature: _____</p> <p>AU Name: <u>Richard Valicenti, M.D.</u></p>	

Radiopharmaceuticals



	Start	Status
Dx: *Liver		
Radiation Oncology Course: 1		
Rad Rx: RT Lobe - Brachytherapy - Yttrium Dose: 12,050 cGy @ 12,050 cGy x 1		A 6/4/2015 VKM
Dx: *On Clinical Study		

Radiation Prescriptions

Dx: *Liver
Course: 1

Site	Technique	Modality	Fractions				Rx Dose		Total Dose
			Act	Rx	Dose	Pattern	Act	Rx	Act
RT Lobe	Brachytherapy	Yttrium		1	12,050 cGy	Daily		12,050 cGy	

Rx Site: RT Lobe
Technique: Brachytherapy
Modality: Yttrium
Dose Spec: Plan

Status: Approved VKM 6/04/2015
View Fractions: By Course
Number Fractions: By Course

Rx Dose	Fractional Dose	Number of Fractions	Fractionation Pattern	Status
12,050 cGy	12,050 cGy	1	Daily	

Week	S	M	T	W	T	F	S
1		1					

Close
Add
Change
Delete
Dosimetry

Note
Plan Dgcs
Status









Radiopharm, cont.

Created: 6/04/2015 VKM Edited: 6/11/2015 SLR Locked:

Subject:

OK
Cancel

F Times New Roman 10 B I U       B

liver brachytherapy

dosi/tx planning:

1. special physics conslut

Radiopharmaceutical: Y-90 TheraSphere; Nordion

Treatment site: RT LOBE

Lung shunt factor: 10%

Planned lung dose: 8.59

Required Y-90 activity: 5 GBQ

Actual Y-90 activity: 5.29 GBQ

Injection date and time: 6/11/2015 11 AM

Delivered target dose: 122.9

Delivered lung dose: 8.76

Total lung dose: 8.76

Maximum allowed lung dose per treatment: 30Gy

Maximum allowed total lung dose: 50Gy

Are electronic signatures ok with legislators? The Theory:

Report of the Advisory Committee on the Medical Uses of Isotopes for Electronic Signatures

April 16, 2012

Subcommittee Members

Bruce Thomadsen, Ph.D., Chair
Chris Palestro, M.D.
John Suh, M.D.
James Welsh, M.D.

Recommendation

The Subcommittee on electronic signatures endorses following the guidance of the E-Sign Act (Public Law No. 106-229), which defines an electronic signature as:

" 15 USC 7006 106 (5) ELECTRONIC SIGNATURE .—The term “electronic signature” means an electronic sound, symbol, or process, attached to or logically associated with a contract or other record and executed or adopted by a person with the intent to sign the record."

The Subcommittee further recommends that the NRC accepts as compliant electronic signatures that satisfy this specification, including, as an example, approving a document with a password or PIN or a digitized signature but not excluding other possibilities.

Discussion

There have been US Government standards for electronic signatures since 1999. The standards follow international protocols. The Public Law cited above follows the NIST standard. This includes approving a document with a password or PIN or any digitized signature such as common at a supermarket checkout. Actually, any mark made with the intention of signing a record is legitimate.

- ❖ Public Law 106-229 as guidance
- ❖ Departmental/institutional policy about validation required
(verbal communication Linda Kroger)

Are electronic signatures ok with legislators? In Practice:

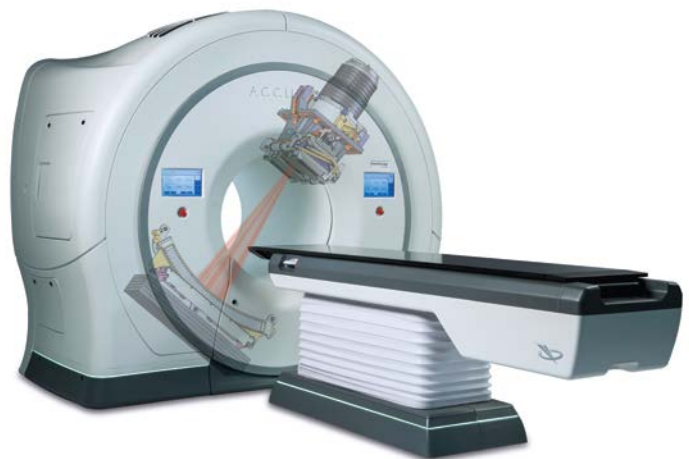
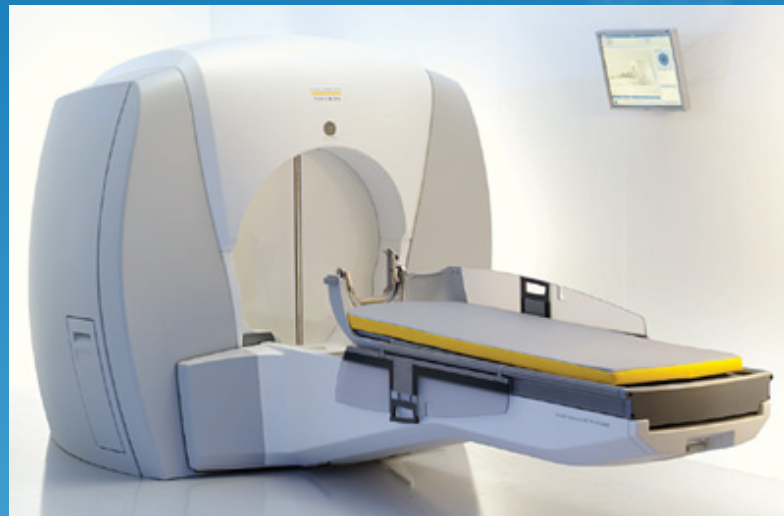
- ❖ Public servants have wide range of comfort level with EMR (they are just like us)
- ❖ Talk to them before you implement EMR (preempts surprises at your next State Inspection)
- ❖ If they have questions, point them to Public Law 106-229 and your policy
- ❖ Address their concerns; regulators are usually helpful folks who want to help you be informed.

Back to the 3 Categories of EMR Connectivity

1. No connectivity
2. Some connectivity
3. Full connectivity (Note: will not cover in detail, same as linac except written directive)



Delivery Devices configured with “No Connectivity”



What workflow is same on LINAC?

❖ Simulation

❖ Prescription

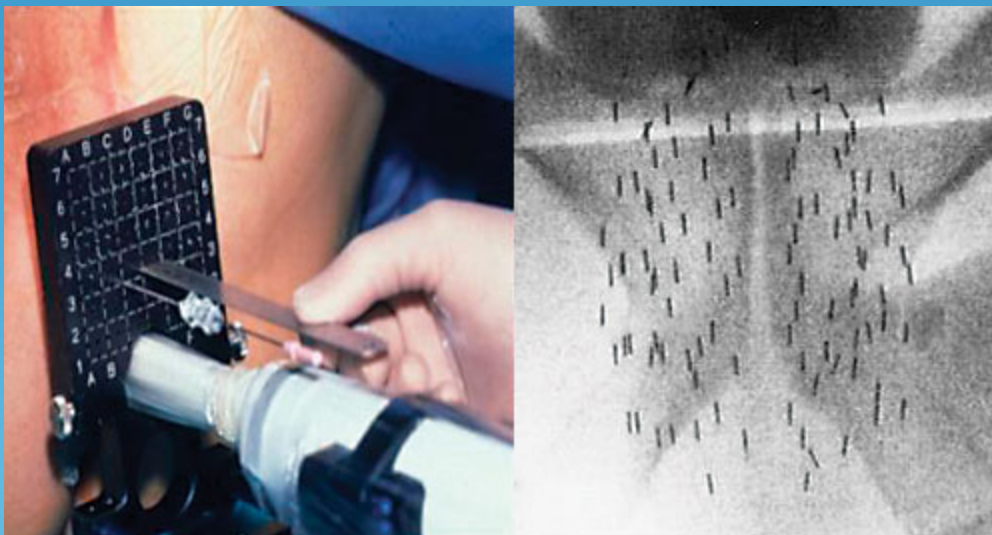
- Not connected to planning even for integrated systems!
- Should be filled out/signed before planning starts

❖ Treatment plan documentation

❖ Checklists used during the process

What is different from LINAC?

- ❖ Process diverges *after* Tx plan is approved
- ❖ Treatment delivery workflow differs
- ❖ Some convergence for weekly QA
- ❖ Converges at final chart check



Solution for Delivery Workflow

- ❖ Treatment Documentation:
 - Pre- and post treatment verification on paper
 - Pre-treatment checklist on paper
 - Scan paper into EMR after treatment
- ❖ Define documentation destination similar to linac workflow
- ❖ Set time by when scan has to be completed
- ❖ Manually create treatment “path” before Tx starts
- ❖ Record treatment IMMEDIATELY after Tx completion
- ❖ Verify documents and dose record at weekly & final chart checks

Example: UCD HDR

The screenshot displays a medical software interface with two main windows. The left window, titled "Diagnoses and Interventions - MR#:", shows a hierarchical tree of orders and plans. The right window, also titled "Diagnoses and Interventions", shows a summary of the patient's condition and a list of documents.

Left Window: Diagnoses and Interventions - MR#:

- Radiation | Medical | Surgery | General | Admin |
- Level: Order Set
- Close
- Add
 - Diagnosis
 - Care Plan
 - Order Set
 - Plan Doc
 - Promote
 - Rad Rx
 - Tx Field
 - Simulation
 - Site Setup
 - Change
 - Delete
 - Refresh
 - Status
 - Dosimetry
 - Archived Objects
 - Couch Copy
- Orders
 - Dx: IIIB: *Endocervix
 - Radiation Oncology Course: 1
 - Rad Rx: Pelvis and PALN - TOMOTHERAPY IMRT - 06 X Dose: 1,080 cGy @ 180 cGy x 15
 - Rad Rx: Pelvis PALN2 - TOMOTHERAPY IMRT - 06 X Dose: 3,800 cGy @ 200 cGy x 19
 - Rad Rx: Rt inguinal bst 1 - ENFACE ELECTRONS - 15e Dose: 600 cGy @ 200 cGy x 3
 - Rad Rx: Lt inguinal bst 1 - ENFACE ELECTRONS - 15e Dose: 600 cGy @ 200 cGy x 3
 - Rad Rx: pelvis and PALN bst1 - TOMOTHERAPY IMRT - 06 X Dose: 400 cGy @ 200 cGy x 2
 - Rad Rx: PALN boost 2 - TOMOTHERAPY IMRT - 06 X Dose: 400 cGy @ 200 cGy x 2
 - Rad Rx: Rt inguinal bst 2 - ENFACE ELECTRONS - 12e Dose: 1,000 cGy @ 200 cGy x 5
 - Rad Rx: Lt inguinal bst 2 - ENFACE ELECTRONS - 12e Dose: 1,000 cGy @ 200 cGy x 5
 - Rad Rx: cervix1 - HDR Interstitial - Ir-192 HDR Dose: 1,400 cGy @ 700 cGy x 2**
 - Plans
 - _Interstitial1.PDF
 - Site Setup
 - Treatment Fields
 - HDR1 - Interstitial1 - 1 X [HDR]
 - Rad Rx: Cervix2 - HDR Interstitial - Ir-192 HDR Dose: 1,400 cGy @ 700 cGy x 2
 - Plans
 - _GYN_INT#2
 - Site Setup
 - Treatment Fields
 - HDR2 - Interstitial2 - 1 X [HDR]
 - Plans
 - _COMPOSITE PLAN.PDF
 - _COMPOSITE PLAN 4880 GY.PDF

Right Window: Diagnoses and Interventions

- MR#: []
- MD: []
- Flowsheets | Assessments | CWS
- Diagnoses and Interventions
 - Endocervix [180.0°] T3b N1 M0 IIIB
- Orders
 - Today: []
 - Future: []
 - Past: []
 - 11/16/2015 V-SIM BRACHY =<X5 + GYN INTERSTITIAL : Approved
 - 11/03/2015 FUSE IMAGES FOR PLAN + SPECIAL PHYSICS CONS : Approved
- Documents
 - 11/25/2015: TX Summary Completed
 - 11/25/2015: Brachy Approved
 - 11/25/2015: Verification Si Approved
 - 11/25/2015: HDR Tx Docs Review Re
 - 11/25/2015: HDR Tx Docs Review Re
 - 11/24/2015: HDR Tx Docs Review Re
 - 11/24/2015: Verification Si Approved
 - 11/24/2015: Procedure Approved
 - 11/24/2015: Verification Si Approved
 - 11/24/2015: Calc 2nd Che Approved

Example: UCD LDR

Diagnoses and Interventions - MR#:

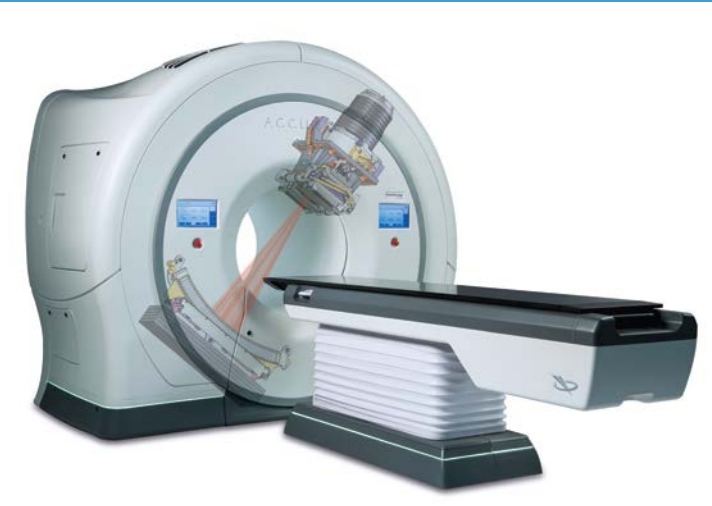
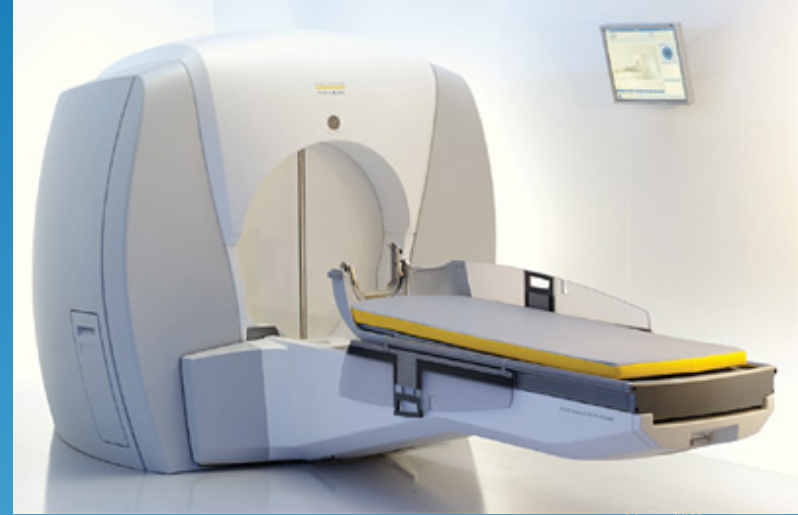
Radiation | Medical | Surgery | General | Admin |

Level: Order Set

- Orders
 - Dx: 0 - Not paired *Prostate Gland
 - Adenocarcinoma, NOS
 - Radiation Oncology Course: 1
 - Rad Rx: Prostate - LDR Brachytherapy - I-125 Dose: 14,500 cGy @ 14,500 cGy x 1
 - Treatment Fields
 - LDR1 - Prostate - 1 X [I -125]
- Plans
 - INTRAOPVERIF FULL REPORT.PDF
 - INTRAOP TX PLAN FULL REPORT.PDF
 - INTRAOP TX SIGNED IN OR.PDF
 - INTRAOP VERIFICATION PLAN SIGNED IN OR.PDF
 - NEEDLES IN.PDF
 - WRITTEN DIRECTIVE.PDF

10/13/2015	Phys Consult Report	Cosign Required	Dieterich, ...	Dieterich, ...	10/13/2015
10/13/2015	Plan Document	Pending			
10/13/2015	Plan Document	Pending			
10/13/2015	Plan Document	Pending			
10/13/2015	Plan Document	Pending			
10/13/2015	Plan Document	Pending			
10/13/2015	Treatment Plan	Approved	Valicenti, ...	Valicenti, ...	10/13/2015
10/13/2015	IP Brachy Prostate	Approved	Valicenti, ...	Valicenti, ...	10/13/2015
9/29/2015	PSI Source Estimate	Cosign Required	Dieterich, ...	Dieterich, ...	9/29/2015
9/16/2015	Consent	Review Required	Carrillo, M...		
9/16/2015	OP/Old Pt SP Note	Approved	Valicenti, ...	Valicenti, ...	9/16/2015
9/16/2015	Sim Pre-Scan	Approved	Valicenti, ...	Valicenti, ...	9/16/2015
7/29/2015	OP/Old Pt SP Note	Approved	Valicenti, ...	Valicenti, ...	7/31/2015
4/23/2015	OP Consult Note	Approved	Valicenti, ...	Valicenti, ...	4/27/2015
3/3/2015	Pathology Report	Review Required	Wood, Cyn...		

Delivery devices configured with “Some Connectivity”



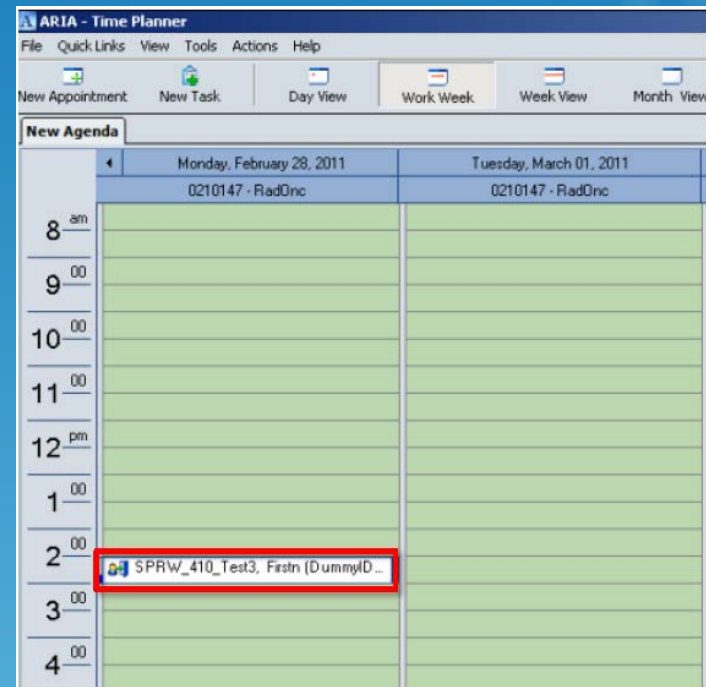
Typical Connectivity Functions (Mileage may vary)

- ❖ Scheduling
 - ❖ Patient demographics
 - ❖ Total delivered MU
- These are the same as for linac! Use the synergy for workflow design



Connectivity Workflow: ARIA

- ❖ Patient is scheduled in EMR
- ❖ Patient checks in
- ❖ Treatment plan now made available on delivery machine
- ❖ EMR is updated with dose delivered at the end of fraction



-



There is always a caveat ...

Note: At the end of treatment, if registration was performed, and the machine is licensed for OIS, a copy of the Registration Screen will be attempted to be sent to the OIS. Currently, both MOSAIQ® and ARIA® do not accept this type of DICOM object.

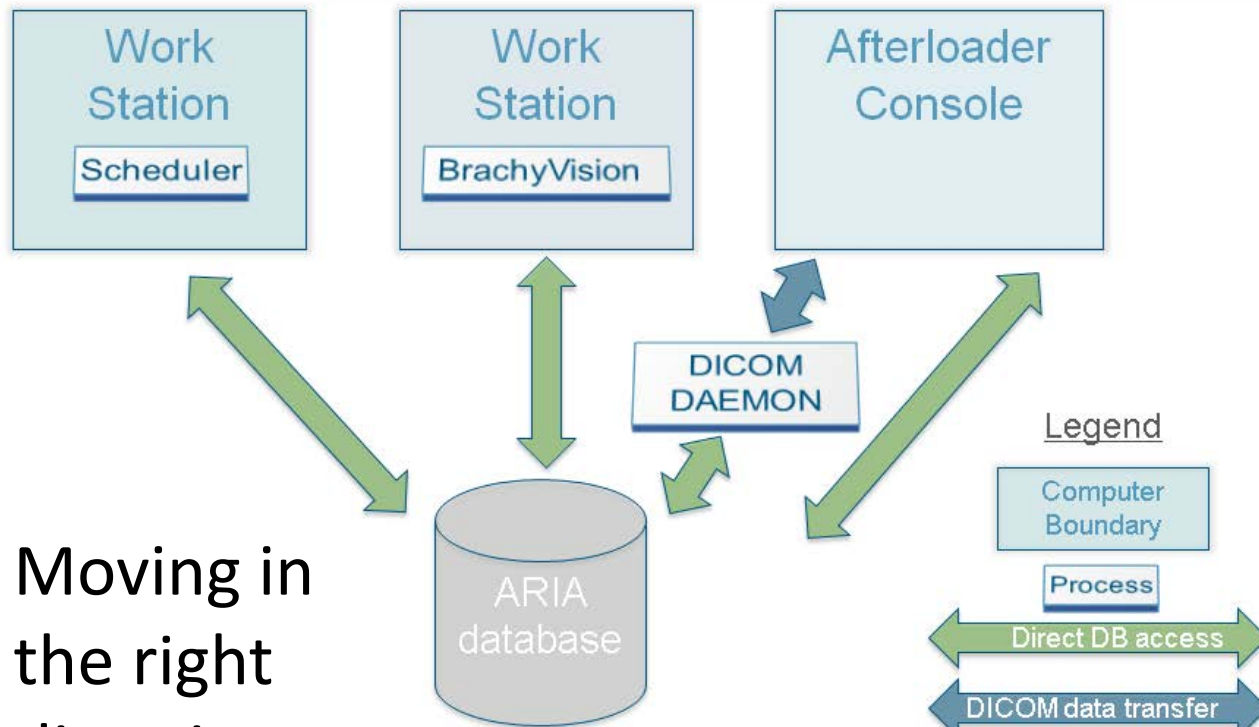
The export screen is only available at this time. It will not be available during a review process.

- ❖ Good example of keeping customer informed
- ❖ Get list of existing tools before making purchase decision
- ❖ Each clinic has to design best workaround workflow depending on your documentation needs
- ❖ Encourage vendors to participate in IHE-RO connectathons!

Full Connectivity: ARIA/Varisource iX

RAD 4145b 2013-01

iX – ARIA Integration



Moving in
the right
direction...

2 | VARIAN ONCOLOGY SYSTEMS

VARIAN
medical systems

Afterloaders

Courtesy S. Richardson

Brachy HDR Workflow

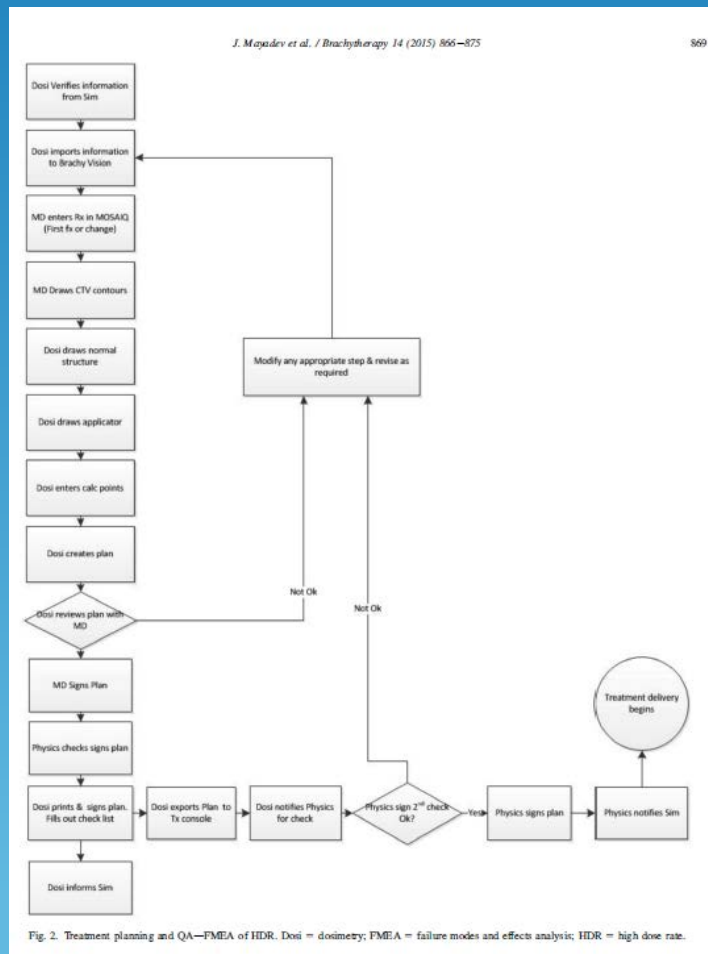
Delivered dose appears in RT Summary & Patient Summary

Safe use of EMR for Brachy/Similar Devices



Workflow

1. Have one!



2. Document it!

UC DAVIS HEALTH SYSTEM Radiation Oncology Department ▶ P&Ps ▶ ... HDR Brachy

UC Davis Radiation Oncology Department Policies & Procedures

Radiation Oncology Department IT Liaison Protocols Vendor Notifications Residency Programs

Libraries

P&Ps

Knowledge Base

Clinical How-to

Calendars

Department Master Calendar

Admin Time Away

Physics Time Away

Tumor Board Calendar

Physician On Call Schedule

Sites

Vendor Notifications

Protocols

IT Liaison

People and Groups

Type	Name
Folder	SAVI
Word Document	Breast Interstitial Checksheet
Word Document	Default Channel Assignments
Word Document	GammaMed HDR Brachytherapy Procedural Pause
Word Document	GammaMed HDR Cylinder Simulation
Word Document	GammaMed HDR Daily Check Procedure
Word Document	GammaMed HDR Daily Check Sheet
Word Document	GammaMed HDR Documentation Flow for Electronic Charting
Word Document	GammaMed HDR Emergency Procedure
Word Document	GammaMed HDR General Procedure
Word Document	GammaMed HDR Planning Procedure for Tandem and Ring Applicator
Word Document	GammaMed HDR Procedure for Using Nucletron Shielded Cylinders
Word Document	GammaMed HDR Treatment Check Procedure
Word Document	GammaMed HDR Treatment Check Sheet
Word Document	Gyn Interstitial Template
Word Document	HDR Prescription Policy

Workflow Alternatives

❖ Network down

❖ XRT:

- treat from a local file OR
- send (some) patients home

❖ Brachy/Other devices:

- Plan transfer from TPS to machine via USB/sneakernet
- Manually enter brachy plan on console from TPS printout
- Both procedures need to be commissioned & documented

Workflow Safeguards May Differ

- ❖ External beam has build-in safety measures in the R&V
 - Cannot treat without approved prescription
 - Cannot treat without physician & physics plan signatures
- ❖ These do not work on partially connected or unconnected devices
- ❖ Need to find alternative safeguards
- ❖ OR environment can be rushed
 - Post-implant written directive while everyone is rushing to finish procedure



Safeguard:

Using QCL checklist in MOSAIQ

Quality Checklist - MR#: 5551212 TESTY, TEST

View: By Patient Patient: TESTY, TEST 5551212

Due	Procedure	Req	Resp	Attending M	Stat	Comment
6/18/2015	Physics- 2nd check	SD		DS		
6/18/2015	Prescription signed	PHY	PHY	DS		Rx complete and approved by attending
6/18/2015	Plan Signatures	PHY	PHY	DS		Plan approved by dosimetrist and attending
6/18/2015	Appl. tip correct	PHY	PHY	DS		Applicators defined correctly; ring offset applied
6/18/2015	Channels per protocol	PHY	PHY	DS		Channel assignments per departmental protocols
6/18/2015	Matches template	PHY	PHY	DS		Interstitial: channel assignment matches template
6/18/2015	Consistent with Rx	PHY	PHY	DS		Planned dose same as Rx dose; point doses & DVH OK
6/18/2015	Conformance < 10%	PHY	PHY	DS		SAVI: air volume < 10% PTV Eval volume
6/18/2015	Dwells verified	PHY	PHY	DS		RadCalc performed, within 3%, uploaded as Calc 2nd check
6/18/2015	Treatment approved	PHY	PHY	DS		Treatment approved in Brachyvision & transfer to console PC

Close

Add

Change

Delete

Complete

Append

Due Date Range

From: 6/15/2015

To: 6/19/2015

Filter By

☐ Complete

☒ Incomplete

☐ All

Safeguard: Using Checklist Document in ARIA

Patient Name: Date:
MRN: Site/Technique:
MD: Nurse:
Patient Identification: Fraction # of

Treatment Planning Checks:

Mosaiq Written directive is signed and dated by authorized user: ☐
Brachyvision Treatment plan- number of catheters and lengths correct: ☐
Brachyvision Treatment plan dose matches written directive prescription: ☐
MU check performed if treating from non-standard plan: ☐

Pre-Treatment checks

Daily QA performed: ☐
Brachyvision Treatment plan transferred to GammaMed afterloader correctly: ☐
Patient was connected to afterloader and checked by 2 individuals: ☐
Calculated treatment time matches afterloader: ☐
$$= \text{Decay Factor} \times \text{treatment planning time} = \text{Total Time}$$
$$= \text{ } \times \text{ } = 0$$

GammaMed wheels locked: ☐
Treatment plan approved in Mosaiq by authorized user: ☐

Safeguard: Using Questionnaire in ARIA

- Checklists (Questionnaires)
- Questions, responses and timestamps all stored in DB

1st Day of Treatment

MLC

☒ Yes ☐ No

Block

☒ Yes ☐ No

- ☒ Check MUs
- ☒ Check field parameters
- ☒ Treatment field energies
- ☒ Field Portal/IGRT/Electron Photo Images Taken
- ☒ Take and Import Treatment Field Photos into ARIA
- ☒ Physicians Intent Reviewed by Attending
- ☒ Consent Signed?

Chart Rounds

Stanford Pathology

☒ Yes ☐ No ☐ N/A

Staging sheet

☒ Yes ☐ No ☐ N/A

- ☒ Radiation therapy treatment consent
- ☒ Radiation therapy treatment summary

Testing the Workflow

❖ Remember E2E tests from Radiosurgery?

❖ Definition from Techopedia:

*“End-to-end testing is a methodology used to test whether the flow of an application is performing as designed from start to finish. The purpose of carrying out end-to-end tests is to identify system dependencies **and to ensure that the right information is passed between various system components and systems.**”*

❖ 2 Steps:

1. Test complete procedure first; solve any issues
2. Send some errors through system, check if caught

Summary

- ❖ Design of EMR flow depends on degree of connectivity
- ❖ Designing the workflow to be most similar to linac is key
- ❖ End-to-end testing is an essential tool for successful implementation
- ❖ Especially for use of byproduct materials, be aware of regulatory requirements

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