An Example Pre-, Intra-, and Post-Procedure Clinical Workflow for General Fluoroscopy and FGI Procedures

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Financial Disclosures

• None

• No discussion today is intended to serve as an advertisement for any company discussed
UF HEALTH SHANDS CORE POLICY AND PROCEDURE

POLICY NUMBER: CP02.095
CATEGORY: Patient Care

TITLE: Fluoroscopy

PURPOSE: To provide CRI prevention guidelines as approved by the Human Use of Radioisotopes and Radiation Committee (HURRC) and in accordance with the recommendations from National Council on Radiation Protection and Measurements (NCRP), specifically NCRP Report No. 168: Radiation Dose Management for Fluoroscopically-Guided Interventional Medical Procedures (2010) and NCRP Statement No. 11: Outline of Administrative Policies for Quality Assurance and Peer Review of Tissue Reactions Associated with Fluoroscopically-Guided Interventions (2014).
UF Health Core Policy

• Fluoroscopic procedures
  • General fluoroscopic procedures – Defined as any procedure involving fluoroscopy not in the areas defined for FGI
UF Health Core Policy

- Fluoroscopic procedures
  - Fluoroscopically-guided interventional (FGI) procedures – Defined as any procedure utilizing fluoroscopy in cardiology, interventional radiology, and OR hybrid
Longitudinal Dose Tracking

• Cumulative air kerma (CAK) tracking dose levels (within previous six months)
  • Level 1: 3 Gy ≤ CAK < 5 Gy
  • Level 2: 5 Gy ≤ CAK < 10 Gy
  • Level 3: CAK ≥ 10 Gy
# Longitudinal Dose Tracking


## Radiation Dose Estimates

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Dose Est.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Kerma</td>
<td>6,491.02</td>
<td>mGy</td>
</tr>
<tr>
<td>IR TIPS</td>
<td>4,677.19</td>
<td>mGy</td>
</tr>
<tr>
<td>IR TIPS</td>
<td>1,698.19</td>
<td>mGy</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Procedure</th>
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<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Fluoro time</td>
<td>67.1</td>
<td>minutes</td>
</tr>
<tr>
<td>IR TIPS</td>
<td>78.9</td>
<td>minutes</td>
</tr>
<tr>
<td>IR TIPS</td>
<td>32.1</td>
<td>minutes</td>
</tr>
</tbody>
</table>

## Table of Dose Estimates

<table>
<thead>
<tr>
<th>Appt Date</th>
<th>dose (Order Level)</th>
<th>6 Month Total Dose Est.</th>
<th>Name</th>
<th>Dose Est.</th>
<th>Unit</th>
<th>Accession #</th>
<th>Service</th>
<th>Referring Physician</th>
<th>Technology</th>
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<tbody>
<tr>
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<td>12.886.4 mGy</td>
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<td></td>
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</table>
Pre-Procedure – Informed Consent

- A patient’s previous radiation history, including radiation therapy, should be taken into account when planning an FGI procedure in the same anatomic region as radiation-damaged skin may be more susceptible to future injury.

- Previously, informed consent obtained from any returning Level 2 or Level 3 patient:
  - Review patient’s history for susceptibility to CRI risk factors
  - Examine planned skin radiation entrance site for possible changes

- Informed consent is now obtained to any patient undergoing procedure in FGI suite, regardless of previous procedures.
Informed Consent for Operative / Invasive Procedure

Date
I, the undersigned, consent to the following operation(s) and / or procedure(s), With the use of radiation and possible high doses of radiation

To be performed by Dr. [Name], and his / her associates and assistants, as indicated below, with knowledge that the primary physician will have primary responsibility for my care associated with the stated procedure.

I understand that physicians who are fellows or residents (resident physicians), may also be involved in the procedure(s), including performing one or more significant tasks. I further understand that if resident physicians are involved:

- They will perform portions of the procedure(s) based on their level of competence.
- It will be decided at the time of the procedure(s) which resident physicians will participate and their manner of participation, taking into account the following factors: 1) my condition, 2) the availability of resident physicians with the necessary competence, and 3) knowledge of the supervising physician of the resident physicians’ skills sets.
- Any resident physicians performing significant tasks will be under the supervision of their supervising physician, therefore, the supervising physician may not be physically present in the same room for some or all of the tasks performed by resident physicians.

I have had the opportunity to ask any questions that I have regarding resident physician involvement. As listed below, certain significant tasks may be performed by qualified medical practitioners who are not physicians, acting within their scope of practice as permitted by State law and their clinical privileges granted by the hospital.

Practitioner Type (check one):
[ ] Advanced Registered Nurse Practitioner
[ ] Physician Assistant
[ ] Certified Registered Nurse Anesthetist
[ ] Other

Dr. [Name] has explained to me the nature and purpose of each operation(s) and / or procedure(s) as well as the substantial risks and possible complications involved, the benefits and the medically reasonable alternative methods of treatment.

The SUBSTANTIAL RISKS include but are not limited to (add additional risks as indicated):
- [ ] perforation and / or injury to adjacent blood vessels, nerves and / or organs
- [ ] bleeding
- [ ] infection
- [ ] Redness, itching, warm feeling, or sensitivity of skin exposed to radiation; blistering and / or peeling of the skin after one to two weeks; [ ] Hair loss in areas exposed to radiation, with high doses hair loss may be permanent; [ ] Tanning of skin exposed to radiation, skin changes may be permanent; [ ] When treatment includes the eyes, they may feel dry, with high doses involving the eye, cataracts may occur as a long-term effect.

The POTENTIAL BENEFITS include but are not limited to: [ ] Improvement of your quality of life; [ ] Non-surgical treatment of medical condition; [ ] Palliation of cancer-related symptoms

The MEDICALLY REASONABLE ALTERNATIVE(s) options are: [ ] Not receiving radiation treatment; [ ] Surgical treatment depending on your medical condition

CONSENT

I hereby consent to the above described operation(s) and / or procedure(s).

Patient Signature: ____________________________
Witness Signature: ____________________________

SIGNATURES FOR CONSENT WHEN GIVEN BY REPRESENTATIVE OF PATIENT

If patient is unable to consent, complete the following:
- [ ] Patient is a minor, or
- [ ] Patient is unable to consent because:

Patient’s Name: ____________________________
Representative’s Name: ____________________________
Representative’s Printed Name: ____________________________
Relationship to Patient: ____________________________
Witness Signature: ____________________________
Witness Printed Name: ____________________________

SIGNATURE OF PHYSICIAN WHO OBTAINED CONSENT

I certify that the procedure(s) described above, including the substantial risks, benefits, possible complications, anticipated outcomes, alternative treatment options (excluding non-treatment) and their attendant risks and benefits, the likelihood of success and the possible problems related to recuperation, were explained by me to the patient or his / her legal representative.

Date: _______ Time: _______
[ ] Consent obtained by telephone.
[ ] Consent obtained with use of interpreter.
Name of interpreter: ____________________________

Signature of Physician Who Obtained Consent: ____________________________

Physician Identification Number: ____________________________

[Date] 2021
[Rev] 001
[PS100742]
Intra-Procedure

• Staff member provides intra-procedural notifications to proceduralist(s)

• Notifications based upon NCRP Report No. 168 recommendations

• Initial notification: 3 Gy CAK

• Further notification: Each 1 Gy CAK after initial 3 Gy CAK
Post-Procedure (pre-2019)

End Exam
SH RAD UF IR APPT-LEVEL EE

Question
1. Trauma:
2. Contrast (mL):
3. Fentanyl (mcg):
4. Versed (mg):
5. Dilaudid (mg):
6. ANES required next procedure?
7. Catheter (French, Name, Length(cm)):
8. Fluoro table height (cm) 9
9. AP Fluoro Time (minutes)
10. Lat Fluoro time (minutes), Bi-Plane Rooms only
11. AP AK (mGy) 1698 mGy
12. Lat AK (mGy), Bi-Plane rooms only 0 mGy
13. Is the patient Supine or Prone?
14. Case Comments:
Post-Procedure (pre-2019)

- Discharge paperwork if procedure results in a Level 2 patient
  - Single procedure SRDL
  - Multiple procedures in six-month span
- Discharge form printed and filled out by technologist present during the procedure
- Technologist would then physically transport form to RCU RNs to include with discharge paperwork
The procedure you recently underwent is one of the more complex interventions performed by our service. This type of procedure is done with x-ray imaging and requires the use of higher radiation doses than most other diagnostic imaging studies, such as chest x-rays or CT scans.

How much radiation you receive depends on your specific procedure and medical condition. To ensure you get the most benefit from your procedure, we make every attempt to minimize the radiation exposure, while recognizing that a portion of your body may receive a substantial dose from the procedure. In general, the risk of complications related to radiation exposure is very small and substantially less than other risks of this procedure.

Your procedure required a dose of radiation at the upper end of our usual range and, while we do not expect to see any effects from this radiation, there is a chance that it could cause skin changes in the area that was treated. These changes might include an area of redness, localized hair loss, itching, or drying of the skin in the exposed area. These changes are usually temporary and fade away in a few days to a week. In very rare situations more severe damage to skin can require medical attention.

Over the course of the next several weeks, please monitor your skin in the designated area and watch for any of the following symptoms. The areas where you may experience changes are marked in the diagrams below. If the area exposed was on your back, have someone check it for you, or do your back by looking in a mirror.

**Signs to look for:**
- A red area, about the size of your hand
- Puckering, like a抽筋
- Areas of localized hair loss
- Constant itching in the affected area

If you see any of these signs, please contact us as soon as possible to determine if any further treatment is needed, or if the changes will resolve without intervention.

Please do your best not to scratch the limited area, as doing so can lead to further changes in your skin.

☐ If you have any questions or concerns, contact Interventional Radiology at 352-205-0150 Monday through Friday between the hours of 8:00 am and 5:00 pm. Ask to speak to a Physician's Assistant.

☐ If you have any questions or concerns, call the Department of Neurosurgery at 352-205-9900 and ask to speak to your doctor.
Post-Procedure (2019-Present)

- Updated system with automatic printing of discharge form with avatar appended to after-visit summary (AVS)
Look for reddening of the skin here
**Patient Education - Add education information for discharge**

**Suggested Discharge Instructions**

- Acute Coronary Syndrome (English)
- Acute Pain Adult (English)
- Angina Easy-to-Read (English)
- Angina (English)
- Aspirin and Your Heart (English)
- Coronary Artery Disease, Risk Factors (English)

**Instructions**

POST-PROCEDURE RADIATION EXPOSURE INFORMATION SHEET

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Over the course of the next several weeks, please monitor your skin in the designated area and watch for any of the following symptoms. The areas where you may experience changes are circled in the diagrams below. If the area exposed was on your back, have someone check it for you, or do your best by looking in mirror.
Patient Education - Add education information for discharge

Suggested Discharge Instructions
- Acute Myocardial Syndrome (Simple)
- Acute Pain Add (English)
- Angina (Simple)
- Angina (English)
- Coronary Artery Disease, Risk Factors (English)

Instructions

POST Procedure Radiation Exposure Information Sheet

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There are no annotated images to display.

Signs to look for:
- A red area, about the size of your hand
- Flaking skin, like a sunburn
- Areas of localized hair loss
- Constant itching in the exposed area

If you see any of these signs, please contact us as soon as possible to determine if any further treatment is needed, or if the changes will resolve without intervention.
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1: Look for reddening of the skin here
After Visit Summary

Review these issues before printing

- Discharge order reconciliation is not complete for this encounter.

HOD After Visit Summary

Selected to print

Done Editing

AFTER VISIT SUMMARY
Echo Cardiology
MIN: 01367500
Date of birth: 2/22/1978

Your Visit
Reason for your visit:
- Unstable angina pectoris (CMS-HCC code) (CMS-HCC)
- Blue baby
- Chest pain due to myocardial ischemia, unspecified ischemic chest pain type
- Chest pain

Your medications have changed
- START taking:
  - 6.9% NaCl
  - Isosorbid (PRINLIZESTRIL)
  - oxycODONE (OxyCONTIN)

Review your updated medication list below.

Your Next Steps
- Do:
  - Pick up these medications from any pharmacy with your printed prescription
    - Isosorbid
    - oxycODONE

What's Next
- You currently have no upcoming appointments scheduled.

Medications I Need to Take After This Visit

Done Editing
HOD After Visit Summary

Instructions

POST-PROCEDURE RADIATION EXPOSURE INFORMATION SHEET

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- A red area, about the size of your hand
- Flaking skin, like a sunburn
- Areas of localized hair loss
- Constant itching in the affected area

If you see any of these signs, please contact us as soon as possible to determine if any further treatment is needed, or if the changes will resolve without intervention.
Patient Follow-Up

• Follow-up is the responsibility of the proceduralist(s) for at least one year after FGI procedure if contacted by FGI patient with concerns for CRI

• Previously, VIR physician assistant (PA) would call patients at specific intervals to check in with patient about possible tissue effects
  • After procedure
  • Six months
  • One year

• Updated core policy places onus on the patient to contact providing service if tissue effects are discovered
Longitudinal Dose Tracking

- Peak skin dose (PSD) calculations for all Level 3 patients

- If PSD > 15 Gy, patient safety report (PSR) is placed, sentinel event may be reported (not required)

- NCRP Commentary 11 recommends that, regardless of PSD, a sentinel event shall not be considered to have occurred for an observed skin effect is all the performed fluoroscopic procedures were deemed to have been performed within practice parameters by a QA/peer review committee
Longitudinal Dose Tracking

• **Peak skin dose calculations are difficult due to uncertainties in many parameters**
  • Backscatter factor
  • Beam orientation and beam motion
  • CAK reading
Longitudinal Dose Tracking (pre-2019)

End Exam
SH RAD UF IR APPT-LEVEL EE

Question
1. Trauma:
2. Contrast (mL):
3. Fentanyl (mcg):
4. Versed (mg):
5. Dilaudid (mg):
6. ANES required next procedure?
7. Catheter (French, Name, Length(cm)):
8. Fluoro table height (cm) 9
9. AP Fluoro Time (minutes)
10. Lat Fluoro time (minutes), Bi-Plane Rooms only
11. AP AK (mGy) 1698 mGy
12. Lat AK (mGy), Bi-Plane rooms only 0 mGy
13. Is the patient Supine or Prone?
14. Case Comments:
Longitudinal Dose Tracking (pre-2019)
Longitudinal Dose Tracking (pre-2019)

### Radiation Dose Estimates

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Dose Est (mgY)</th>
<th>Unit</th>
<th>Anatomical 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Kerma</td>
<td>6,491.02</td>
<td>mgY</td>
<td></td>
</tr>
<tr>
<td>IR TIPS</td>
<td>4,677.19</td>
<td>mgY</td>
<td></td>
</tr>
<tr>
<td><strong>IR TIPS</strong></td>
<td>1,698.19</td>
<td>mgY</td>
<td></td>
</tr>
<tr>
<td>Fluoro Time</td>
<td>67.1</td>
<td>minutes</td>
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<tr>
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<td>70.9</td>
<td>minutes</td>
<td></td>
</tr>
<tr>
<td>IR TIPS</td>
<td>32.1</td>
<td>minutes</td>
<td></td>
</tr>
</tbody>
</table>

### Study Result

- Procedures performed:
  - Ultrasound-guided vascular access
  - Fluoroscopic guidance
  - TIPS revision and stent placement

### Report

- Date: 19/03/2019
- Interventions:
  - Revision
  - Clinic referral
- Type: Elective
- Private Encounters: No
- Accident Related: No
- End Exam:
  - S1 RAD IR/IP LEVEL II
    - Question: What is the reason for the intervention?
    - Answer: Revision
    - Comment: Ultrasound-guided vascular access
  - Question: What is the patient’s position?
    - Answer: Supine
    - Comment: Fluoroscopic guidance

### Dose Estimation

<table>
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<td></td>
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<tr>
<td>IR TIPS</td>
<td>32.1</td>
<td>minutes</td>
<td></td>
</tr>
</tbody>
</table>

### Additional Information

- Procedure: IR TIPS
- Date: 19/03/2019
- Intervention: Revision
- Type: Clinic referral
- End Exam: S1 RAD IR/IP LEVEL II
- Question: What is the reason for the intervention?
  - Answer: Revision
  - Comment: Ultrasound-guided vascular access
- Question: What is the patient’s position?
  - Answer: Supine
  - Comment: Fluoroscopic guidance
### Longitudinal Dose Tracking (pre-2019)

#### Radiation Dose Estimates

<table>
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<tr>
<th>Procedure</th>
<th>Dose Est. Unit</th>
<th>Anatomical Regions</th>
<th>Exam Date</th>
<th>Technologist</th>
<th>Edited?</th>
<th>Report</th>
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</thead>
<tbody>
<tr>
<td>IR TIPS</td>
<td>6.481.62 mGy</td>
<td></td>
<td>11/1/2019</td>
<td>BOTH, HEATHER C</td>
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<tr>
<td>IR TIPS</td>
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<td>2/23/2020</td>
<td>JAMES, KEATY NICHOL</td>
<td>Y</td>
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</tr>
<tr>
<td>IR TIPS</td>
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<td>3/4/2023</td>
<td>DAVID, AMANDA L</td>
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<td>IR TIPS</td>
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<td></td>
<td>3/4/2023</td>
<td>DAVID, AMANDA L</td>
<td>Y</td>
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#### CAK (last 6 months)

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>IR TIPS</td>
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<td></td>
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<tr>
<td>IR TIPS</td>
<td>4677.19 mGy</td>
<td></td>
<td>3/4/2023</td>
<td>DAVID, AMANDA L</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>IR TIPS</td>
<td>1698.19 mGy</td>
<td></td>
<td>2/23/2020</td>
<td>JAMES, KEATY NICHOL</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

#### PSD from single procedure

<table>
<thead>
<tr>
<th>Procedure</th>
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<th>Anatomical Regions</th>
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<th>Report</th>
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</thead>
<tbody>
<tr>
<td>IR TIPS</td>
<td>12866.4 mGy</td>
<td></td>
<td>2/23/2020</td>
<td>JAMES, KEATY NICHOL</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>IR TIPS</td>
<td>5.32 mGy</td>
<td></td>
<td>3/4/2023</td>
<td>DAVID, AMANDA L</td>
<td>Y</td>
<td></td>
</tr>
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<td>IR TIPS</td>
<td>2.54 mGy</td>
<td></td>
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<td>Y</td>
<td></td>
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<td></td>
<td>3/4/2023</td>
<td>DAVID, AMANDA L</td>
<td>Y</td>
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<td>2/23/2020</td>
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#### Months since procedure

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<tr>
<th>Procedure</th>
<th>Dose Est. Unit</th>
<th>Anatomical Regions</th>
<th>Exam Date</th>
<th>Technologist</th>
<th>Edited?</th>
<th>Report</th>
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#### Single procedure

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<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
Longitudinal Dose Tracking (pre-2019)

• Problems with this system?
  • Compliance
  • Technologist error
  • Technologist workload
  • Physicist error
  • Availability and organization of CAK tracking database
  • Lack of notifications
  • PSD estimate accuracy
Longitudinal Dose Tracking (2019-Present)

- Dose monitoring software utilized for patient CAK tracking
- DoseMonitor® (developed by PACSHealth®) utilized with EPIC integrations
- Dose information is captured through RDSRs and passed into patient EMR
Longitudinal Dose Tracking (2019-Present)

End Exam
SH RAD UF IR APPT-LEVEL EE
Question
1. Trauma:
2. Contrast (mL):
3. Fentanyl (mcg):
4. Versed (mg):
5. Dilaudid (mg):
6. ANES required next procedure?
7. Catheter (French, Name, Length(cm)):
8. Fluoro table height (cm)
9. AP Fluoro Time (minutes)
10. Lat Fluoro time (minutes), Bi-Plane Rooms only
11. AP AK (mGy)
12. Lat AK (mGy), Bi-Plane rooms only
13. Is the patient Supine or Prone?
14. Case Comments:

Height = 9
1698 mGy
Longitudinal Dose Tracking (2019-Present)

Height = 9

1698 mGy
Longitudinal Dose Tracking (2019-Present)
Longitudinal Dose Tracking (2019-Present)
Longitudinal Dose Tracking (2019-Present)
Longitudinal Dose Tracking (2019-Present)

Radiology Report
Status: FINAL

Patient Information | Study Information
--- | ---
Patient Name: | Accession Number:  
Patient ID: | 
Referring Physician: | Study Date: 
Interpreted by: | Signed Description: 
Signed by: | 

Procedures performed:
Ultrasound-guided vascular access
Fluoroscopic guidance
TIPS revision and stent placement

Estimated blood loss: minimal

Dose (RP):

Hemodynamics POST STENT (mmHg)
Right Atrium: 15
Portal Venl: 17

IMPRESSION:
Impression:
1. Thrombosed TIPS stent and main portal vein successfully revised with 12 mm balloon angioplasty and stent extension using a 12 mm x 90 mm Vici stent.
2. Final portal venography was performed, demonstrating brisk hepatopetal flow through the vein.
Inpatient Workflow

- Posed significant issue from original policy standpoint

- Outpatients
  - Patient goes home
  - If level 2 patient, discharge paperwork goes with them
  - Discharge paperwork gives instructions to patient

- Inpatients require hospital staff for follow-up

- Discharge paperwork must then follow with patient once they leave hospital
  - Old method of physical form being filled out not plausible
  - New method solves this issue
General Fluoroscopy

• General fluoroscopic units are exempt from most of the requirements in UF Health core policy

• Units are not connected to dose tracking software

• CAK dose page sent to PACS, if available
  • Older equipment without CAK record fluoroscopy time in patient EMR

• If fluoroscopy time > 30 minutes, qualified personnel or their designee complete the dose collection form
Fluoroscopy Time Log Sheet – CP02.093

TO BE COMPLETED BY PROCEDURAL STAFF IF RAD TECH NOT PRESENT FOR CASE
(PLEASE COMPLETE BEFORE EQUIPMENT IS TURNED OFF)

**Complete form only if Fluoro time exceeds 30 minutes**

Location:
- UF Health Shands Hospital
- UF Health Shands Cancer Hospital
- UF Health Shands Children's Hospital
- UF Health Neuroradiology Hospital
- UF Health Heart & Vascular Hospital
- Other: ____________________________

C-Arm/Fluoro equipment used: ____________________________

Fluoro Time (as displayed on equipment): ________________ (min)

Date of Exam: ____________________________

Procedure: ____________________________

Cumulative Air Kerma (as displayed on equipment): ________________ (rad Gy)

Physician's Name: ____________________________

Completed forms should be returned to UF Health Shands Hospital, room G310 or mailed to P.O. Box 100374.
Informed Consent

- As radiology policy, all returning Level 2 and Level 3 patients were provided informed consent about procedure
- Patient history evaluated for risk factors of CRI
- Skin site examined for possible changes due to radiation exposure
- With extension to hospital policy, returning patients being consented presented an issue
  - Coordination between departments
Surgery

• VIR manages techs operating OR hybrid labs

• Clinical workflow is identical

• Identical status board

• Additional pre-procedure work-up
  • Flag patients that have had previous procedures

• Patient follow-up
  • Addressed in post-surgery clinical follow-up
Cardiology

- One of the largest hurdles in the entire fluoroscopy policy and fluoroscopic dose management involved cardiology.

- No Radiant setup in EPIC.

- McKesson PACS build for hemodynamic monitoring:
  - McKesson does not accept RDSRs.

- How to link to dose tracking software?

- How to setup in EPIC build?
Cardiology

- Linking to dose tracking software
Cardiology

- Linking to dose tracking software
### Cardiology

- **How to setup in EPIC build?**

---

<table>
<thead>
<tr>
<th>Time</th>
<th>Patient</th>
<th>Age</th>
<th>Room</th>
<th>Status</th>
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Tribulations…

• Whole process appears smooth…
  • Many, many, many issues experienced during process
  • > 8 year process to get to this point
  • Many needs still not satisfied, but lots of progress has been made
Tribulations...

- EPIC custom-built client
  - CAK summing and status board built to match feature of previous home-build IR system
  - Old system had CAK and status board indicator
Tribulations…

• EPIC custom-built client
• Long process (i.e. years) to achieve generic body avatar incorporation into the patient EMR
Tribulations...

- EPIC custom-built client
  - New core policy + push from Quality + helpful I.T. personnel = PROGRESS
  - Needed unified policy throughout all departments
  - Involved surgery, cardiology, radiology, IT (physician, technologist, physics, and nursing involved)
  - Formation of ad hoc committee
- Issues to solve
  - Informed consent process
  - Incorporation of discharge instructions into AVS
  - Determination of follow-up responsibilities
  - Returning vs. non-returning level 2 patients
• EPIC custom-built client
  • Biggest workflow issue to still solve is the returning level 1 patient who becomes a level 2 patient due to multiple procedures
  • Example patient 1
    • Two procedures in 48-hour period
    • Procedure 1 – 4,999 mGy
    • Procedure 2 – 4,999 mGy
    • Total CAK ~ 10 Gy
    • This patient **never** receives discharge instructions
  • Example patient 2
    • Single procedure
    • CAK = 5 Gy
    • This patient receives discharge instructions
Tribulations...

- Patient comes in as level 1 patient
Tribulations…

• CAK must pass from unit to PACS to the dose tracking software and then back to EPIC

• EPIC then sums fields for each procedure
  • Takes time
  • Requires closing exam
Tribulations...

- Techs often do not close exams for long time post-procedure.
- Techs will not manually sum up CAK.
- Misunderstood discharge paperwork policy years ago.
- Currently, only patients who receive single SRDL receive discharge instructions.
Tribulations…

• Customizing dose tracking software
  • Thought of as a “magic box” of sorts
    • Link it with the systems, it takes care of everything else
  • In practice, for effective system, lots of upfront work and continuing maintenance is needed
Tribulations...

- Customizing dose tracking software
- Six-month longitudinal dose tracking ability
### Tribulations...

- Customizing dose tracking software
- Six-month longitudinal dose tracking ability

<table>
<thead>
<tr>
<th>Date</th>
<th>Patient</th>
<th>Studies</th>
<th>In Days</th>
<th>Dose Type</th>
<th>Total</th>
<th>Rule</th>
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<tr>
<td></td>
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<td>Dose (RP)</td>
<td>5614.95</td>
<td>XA Cumulative Dose(RP) &gt; 5 Gy in 180 days</td>
<td>-</td>
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A patient at Shands Cancer Hospital on device GNV STIR 1 accumulated a total Dose (RP) of 5614.95 mGy which exceeds a threshold of 5000 within the last 180 days. Use the following link to view notification details. [http://10.14.132.91/NX/Alerts/PatientAlert/Edbr/778](http://10.14.132.91/NX/Alerts/PatientAlert/Edbr/778)
Tribulations…

- Customizing dose tracking software
- Integrations – EPIC, PowerScribe
Tribulations...

- Peak skin dose calculations
  - Inherent accuracy of calculation
  - Room-by-room custom table transmission factors
  - Vendor-specific issues
Tribulations...

- Multi-site incorporation and server issues
  - Missing patients
  - Lengthy time between procedure close and email alert (days, in some instances)
  - Some patients missing appropriate paperwork
  - Solution: New server
    - Single server purchased to handle both UF Gainesville and Jacksonville CT and fluoroscopy dose management
    - Server issue fixed with upgraded 8-core server
    - No longer server sharing between sites
Tribulations…

- Physician and administrative issues
  - Cost
  - Physician approval
Tribulations...

- Physician and administrative issues
  - In contrast with the TJC fluoroscopy sentinel event standard, Stecker et al. (2009) recommends different timelines with respect to longitudinally tracking CAK
    - Society of Interventional Radiology (SIR) recommends longitudinal dose tracking on fluoroscopic procedures of the same anatomic region within 60 days