HOW TO DECREASE RADIATION EXPOSURE TO OPERATORS & ASSISTANTS DURING STANDARD & COMPLEX EVAR

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DISCLOSURE

• Consulting fees (All paid to Mayo)
  Cook Medical Inc., WL Gore, GE Healthcare

• Research grants (All paid to Mayo)
  Cook Medical Inc., WL Gore, GE Healthcare

• Off label technique
  Up and over IBD deployment

ADVANCED IMAGING

INCREASING VOLUME

FLUOROSCOPY TIME

EFFECTIVE DOSE
**Golden Rules**

1. **1st Rule Before Procedure**
   - Find ideal work positions
   - Examples: 23 CRA, 12 RA, 0 CAU

2. **2nd Rule: No Lead, No X-Ray**
   - Comparison from femoral vs brachial exposure

3. **3rd Rule: Optimize System Geometry**
   - High detector – High Table
   - High detector – Low Table

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**Operator Dose per Case**

<table>
<thead>
<tr>
<th>Years</th>
<th>System 1</th>
<th>System 2</th>
<th>System 3</th>
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<tbody>
<tr>
<td>2007-2008</td>
<td>26 ± 3</td>
<td>20 ± 2</td>
<td>9 ± 4</td>
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<td>2009-2010</td>
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<td>2011-2012</td>
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<td>2017-2018</td>
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**Mean Radiation Dose (mR)**
- System 1: 26 ± 3
- System 2: 20 ± 2
- System 3: 9 ± 4

**M.J. Ray, W.B. Taylor III, J.T. Weber, C.M. Savage.**
3rd RULE OPTIMIZE SYSTEM GEOMETRY

Low detector – High Table

4th RULE USE LOWEST ACCEPTABLE DOSE RATE

- IQ+ Normal: 30fps
- IQ+ Normal: 15fps
- IQ+ Low: 15fps
- RDL+ Low: 7.5fps
- RDL Low: 3.75fps

5th RULE USE FUSION IMAGING

6th RULE AVOID MAGNIFICATION

7th RULE AVOID DSA
1 DSA = 500 Fluoro Images

Prefer fluoro loop instead of DSA, except for competitive angi or difficult situations.

8th RULE AVOID C-ARM ANGULATION
>30° angulation = exponential increase in dose rate
LESSONS LEARNED

PREOP
- Case selection
- Sizing and planning
- Healthy necks
- Conduits?
- Design selection
- How to breach? Pre-loaded system?

INTRAOP
- Spinal injury prevention
- Target approach
- CSF drainage
- Neurostimulation
- Early limb reperfusion
- Optimized imaging
- Lower radiation dose
- Attention to technique
- “Bail out” maneuvers

POSTOP
- Meticulous care
- Medical therapy
- Antiplatelets
- Statins
- Beta blockers
- ACE
- Surveillance
- Reinterventions