

# Endovascular Simulators Reduce Patient and Staff Exposure

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I N N O V A T I O N | E D U C A T I O N | I N T E R V E N T I O N

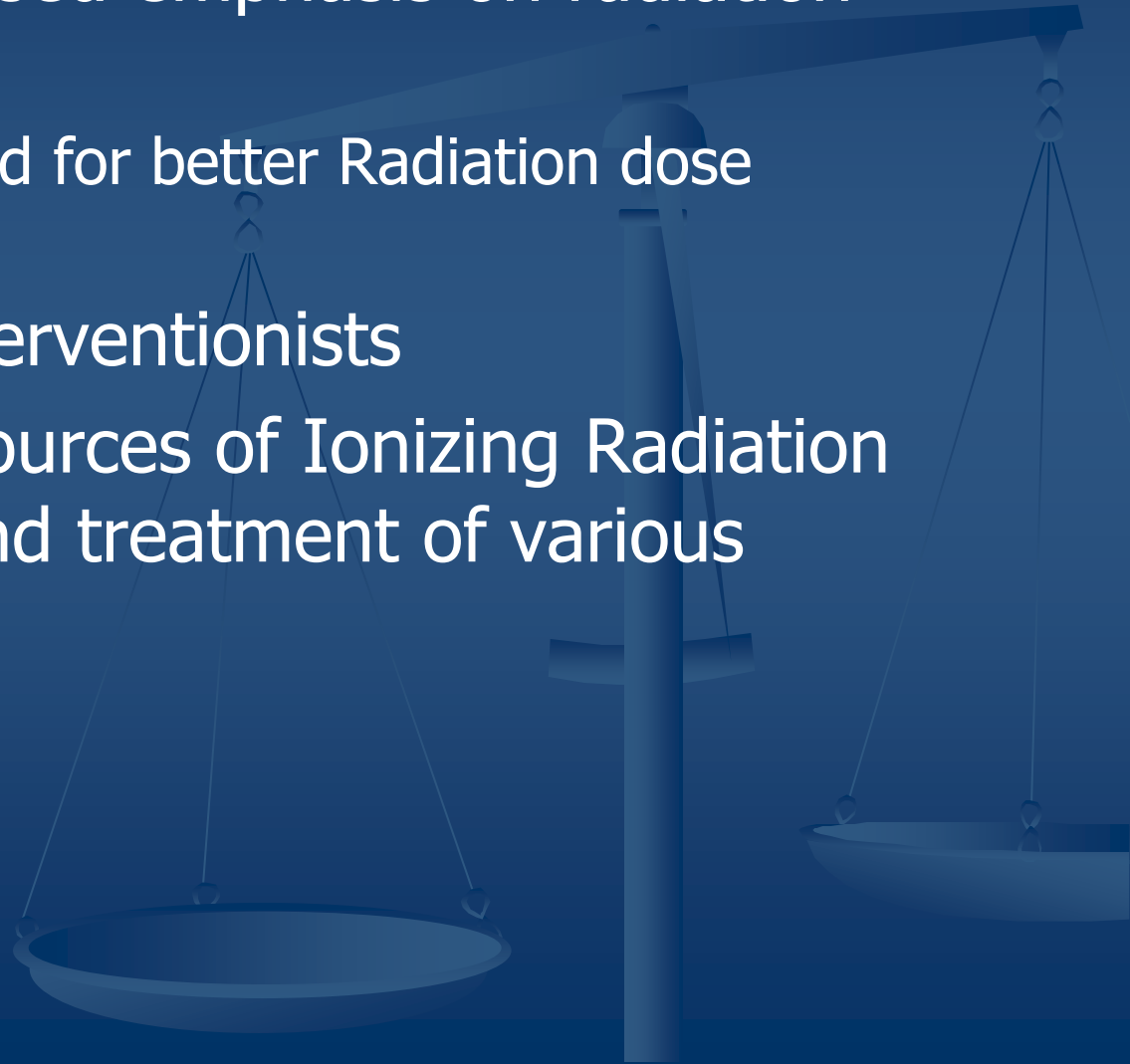


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# Basic Facts

- There is an increased emphasis on radiation safety
  - It created the need for better Radiation dose management
- Image Guided Interventionists
  - Use powerful sources of Ionizing Radiation for diagnosis and treatment of various pathologies



# Introduction

- Interventional Radiologist (IR) carefully plans each Interventional procedure
  - consulting the referring Physician
  - providing detailed explanation on the procedure to the patient
  - finally, obtaining an informed consent
- Such an attitude is part of our daily routine, but usually it does not include
  - specific, case tailored means of Dose Management
  - and patient, as well as staff Radiation Protection

# Interventional Radiology Simulation: Prepare for a Virtual Revolution in Training

- It is becoming increasingly difficult to learn interventional radiology (IR) skills because:
  - There are fewer “straightforward” invasive diagnostic imaging studies,
  - Reduction in the time available for training,
  - Concerns about patient safety,
  - Changing patient perceptions.

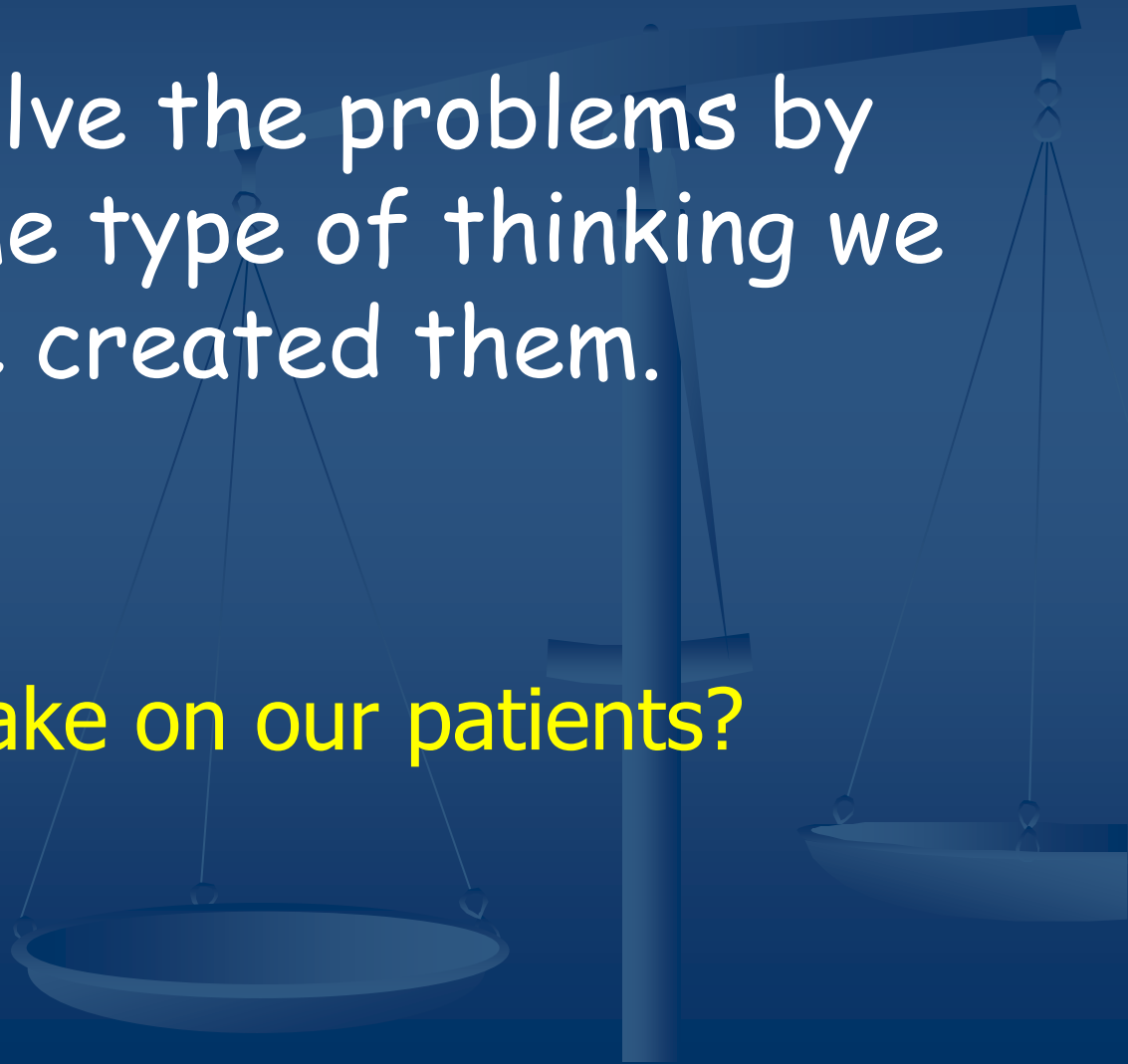
Derek Gould, JVIR Volume 18, Issue 4, 483-490 (April 2007)

# Err is HUMAN!

- We cannot solve the problems by using the same type of thinking we used when we created them.

Albert Einstein

- Should we mistake on our patients?

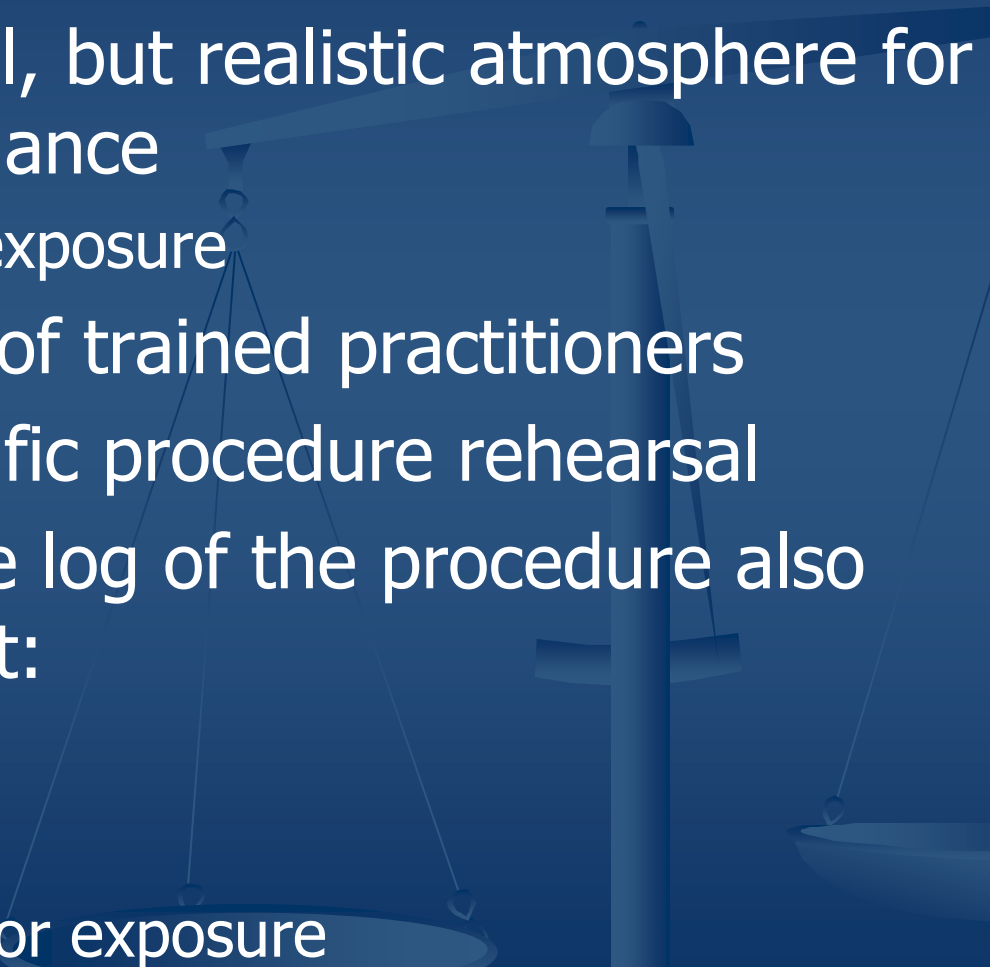


# Radiation Protection Simulation - Goals

- Build up physician's awareness to dose levels during interventions
- To provide tools for dose reduction methods
- To practice dose management as an integral part of the hands-on simulation
  - shorten procedure and fluoroscopy time
- To provide scoring and subjective performance metrics
  - measure results
  - follow-up improvement



# Endovascular Simulators

- Shorten the training course
  - Provide safe virtual, but realistic atmosphere for procedure performance
    - without radiation exposure
  - Improve the skills of trained practitioners
  - Allow patient specific procedure rehearsal
  - Provide a complete log of the procedure also taking into account:
    - Fluoroscopy time
    - Patient exposure
    - Estimate of operator exposure
- 

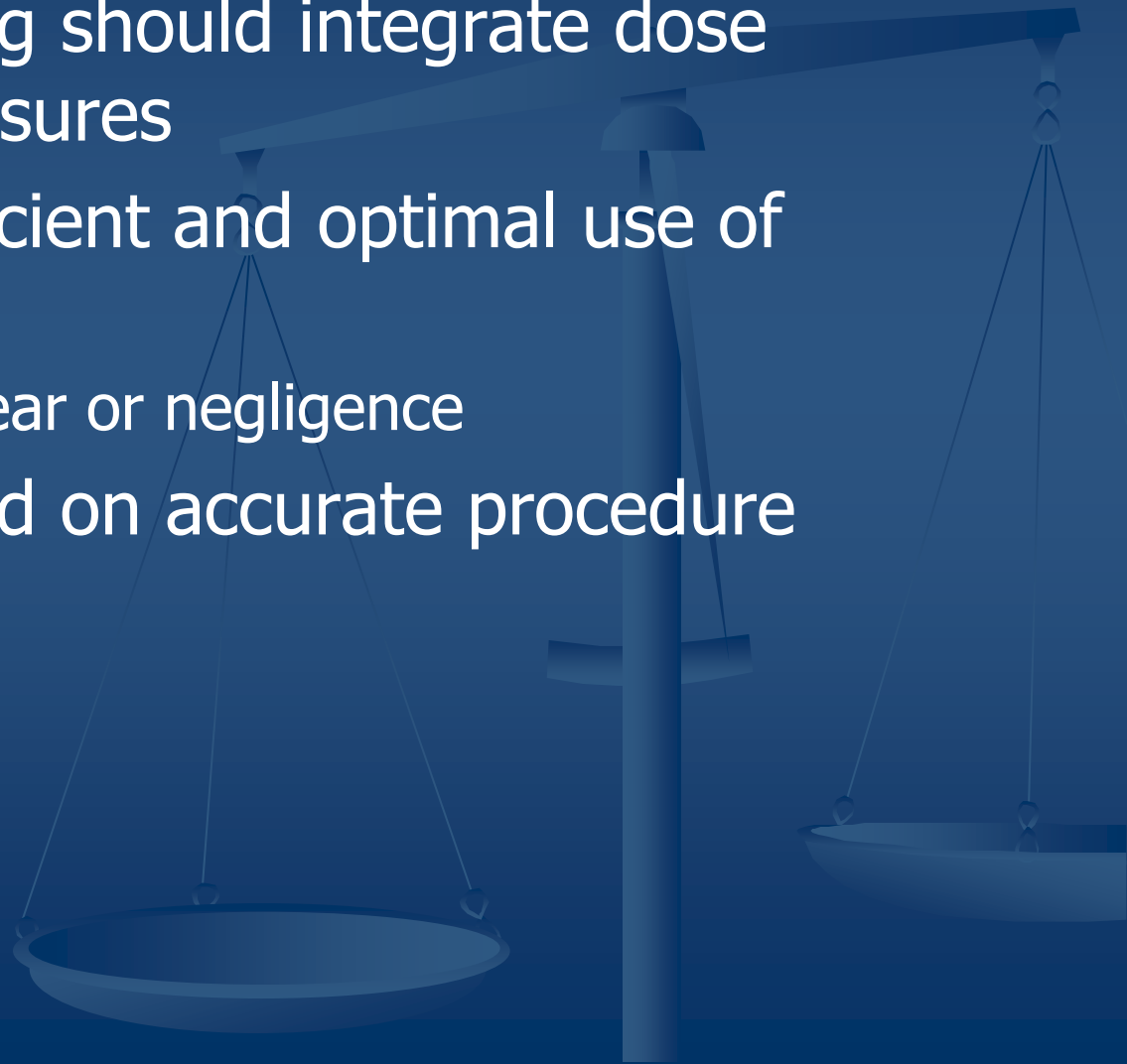
# Pre-procedural Imaging

- CTA and/or MRA should be routinely used prior to almost any endovascular procedure.
- Can be uploaded on the Simulator
- Good pre procedural imaging allows:
  - proper planning of access,
  - choice of selective catheters for quick access,
  - safe and accurate performance of the intervention



# Procedure Planning

- Procedure planning should integrate dose management measures
- The goal is an efficient and optimal use of radiation
  - not an irrational fear or negligence
- Simulation is based on accurate procedure planning



# Procedure planning and Radiation Exposure

- We are very much aware of any possible procedure related complication and do the utmost to prevent it
- The most important contributor of the radiation exposure in Interventional Radiology is Fluoroscopy
- Time efficient performance of procedure will ultimately lead to lower fluoroscopy time, less DSA runs and reduce exposure dose

# Any Feature of Cath. Lab Equipment can be simulated

- State of the Art Angiography systems have
  - Virtually unlimited Fluoroscopy time,
  - DSA,
  - Road Maps,
  - Cone-beam CT and many other options that are based on Ionizing Radiation
    - Work in progress

# Realistic Simulation

- Realistic physical simulation and tactile sensations of interventional devices
- Realistic clinical environment, using real industry devices and tools



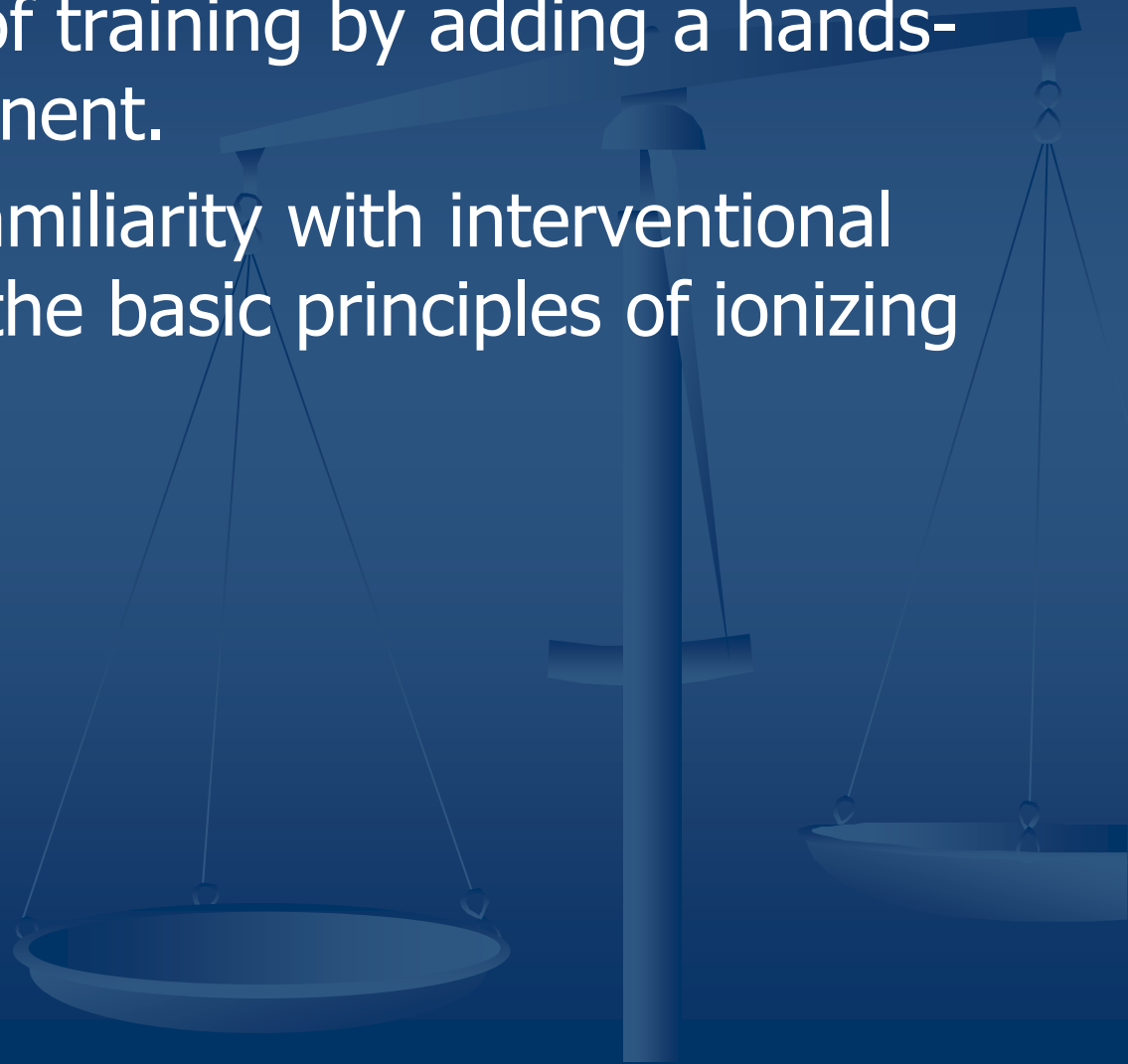
A faint, stylized image of a balance scale is visible in the background. The scale is tilted, with the right pan being higher than the left pan. The pans are empty. The entire image has a dark blue background.

# Finally it's coming!

Radiation protection Simulation becomes  
an integral part of any Simulation system

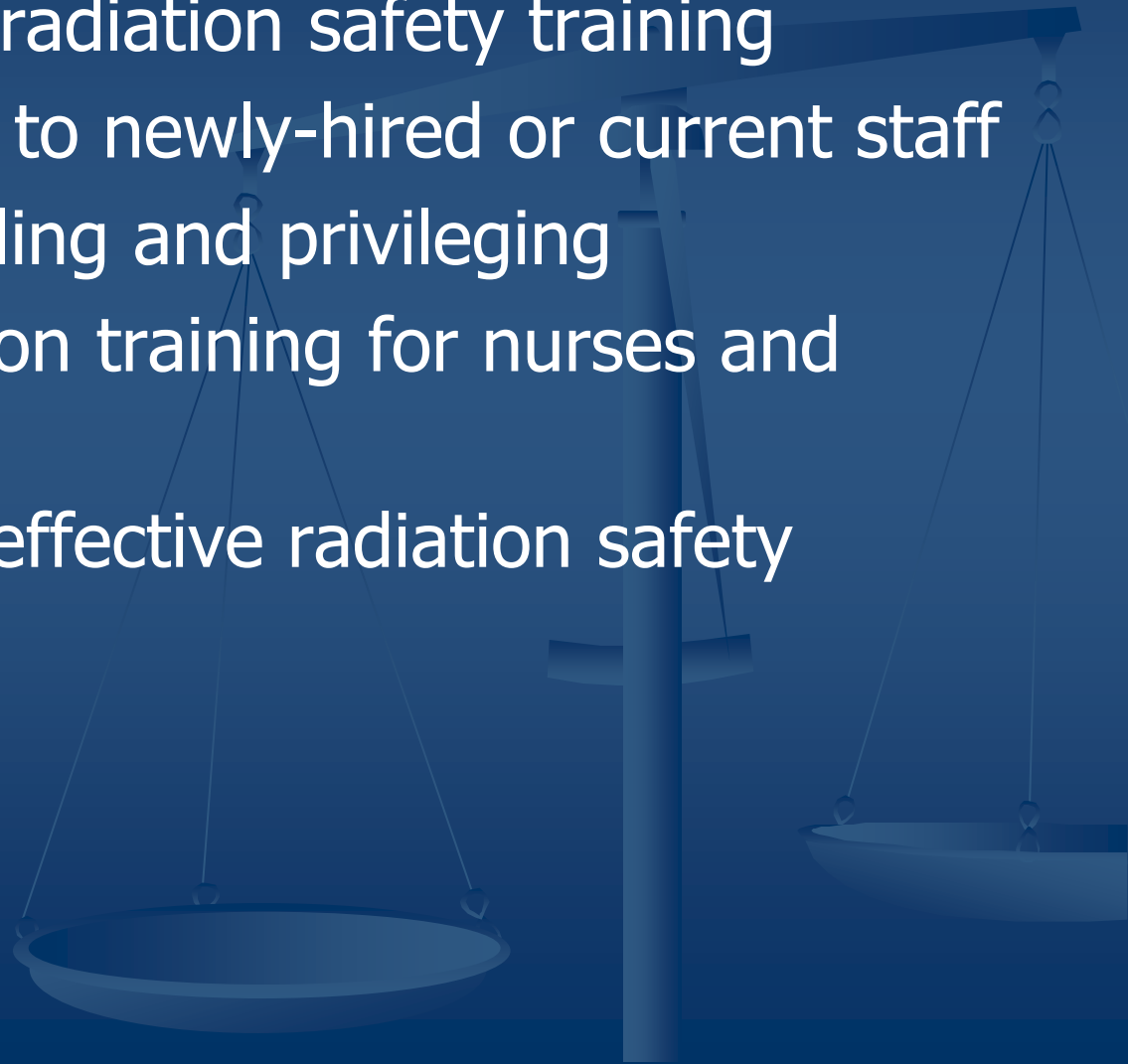
# Mentice Radiation Safety Plug-in

- Increases value of training by adding a hands-on ALARA component.
- Assumes some familiarity with interventional fluoroscopy and the basic principles of ionizing radiation.



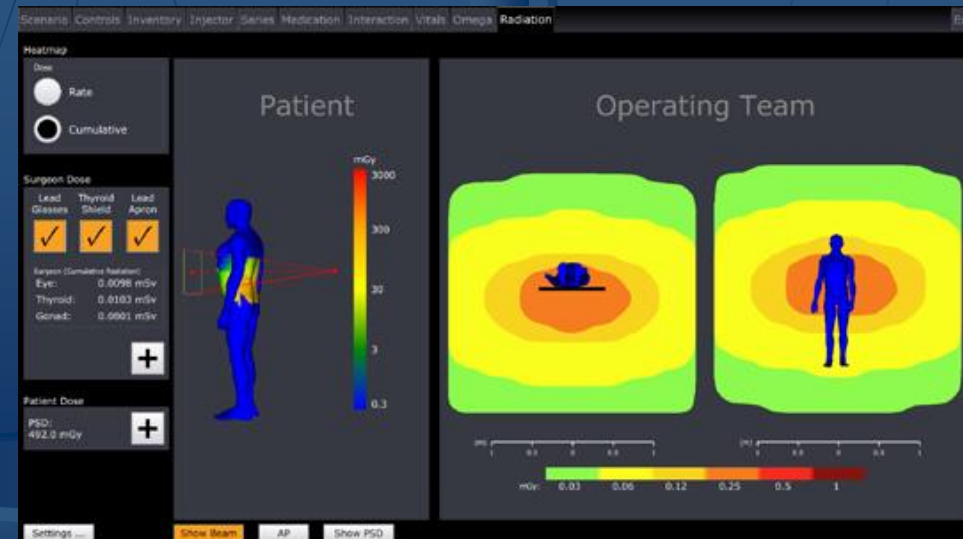
# Mentice Radiation Safety

- Realistic and safe radiation safety training
- Hands-on training to newly-hired or current staff
- Hospital credentialing and privileging
- Skill center radiation training for nurses and techs
- Implementing an effective radiation safety program



# Mentice Radiation Safety Plug-in

- Instructive visual heat-maps with live information on current dose distributions are displayed for:
  - patient skin dose
  - scattered radiation to the operator and team
- Advanced functionalities:
  - estimation of eye doses,
  - Optimization of radiation reduction skills in radiation-free environment





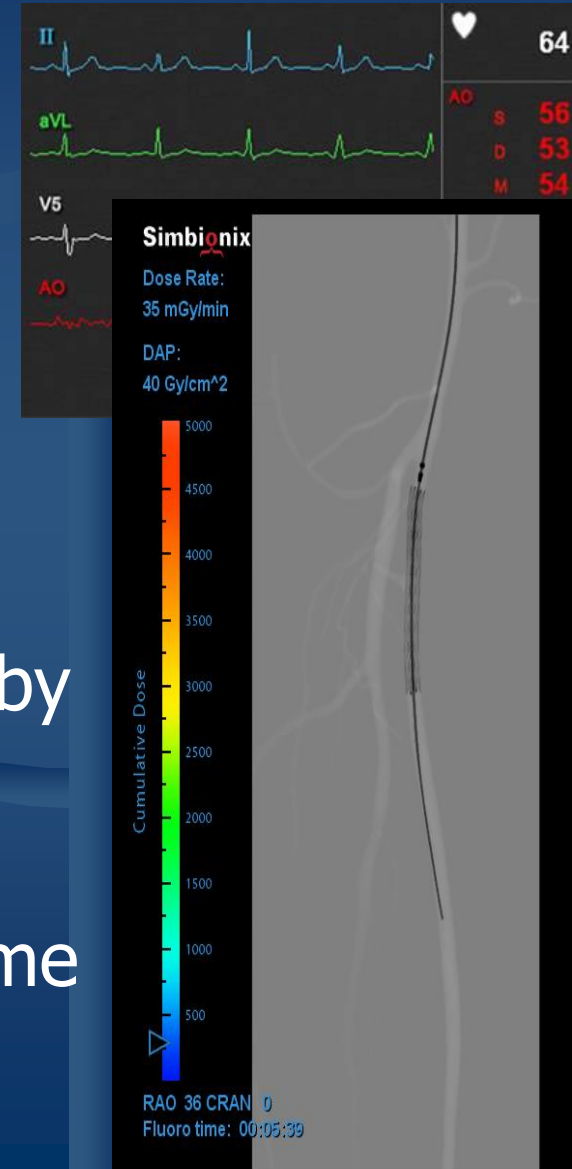
# 3DS Simbionix

## Patient Specific Simulation

- Allows procedure clinical rehearsal (510K clearance)
- Upload patient CTA scans to create 3D models or import 3<sup>rd</sup> party model to simulate, analyze and evaluate preprocedural options
- Is aimed to reduce user errors and improve outcomes
- Creates an unlimited growing library of patient specific cases
  - allows sharing cases among users
- Patient specific dose simulation (work in progress)

# Patient Monitoring

- Simulation of clinical routines:
  - virtual patient vital signs monitoring
- Vital signs simulation reflects:
  - Procedure outcome,
  - Proper choice of administered drugs,
  - intra-procedural complications
- ACT level is monitored and affected by Heparin administration
- Radiation Dose monitoring as an integral part of the procedure outcome

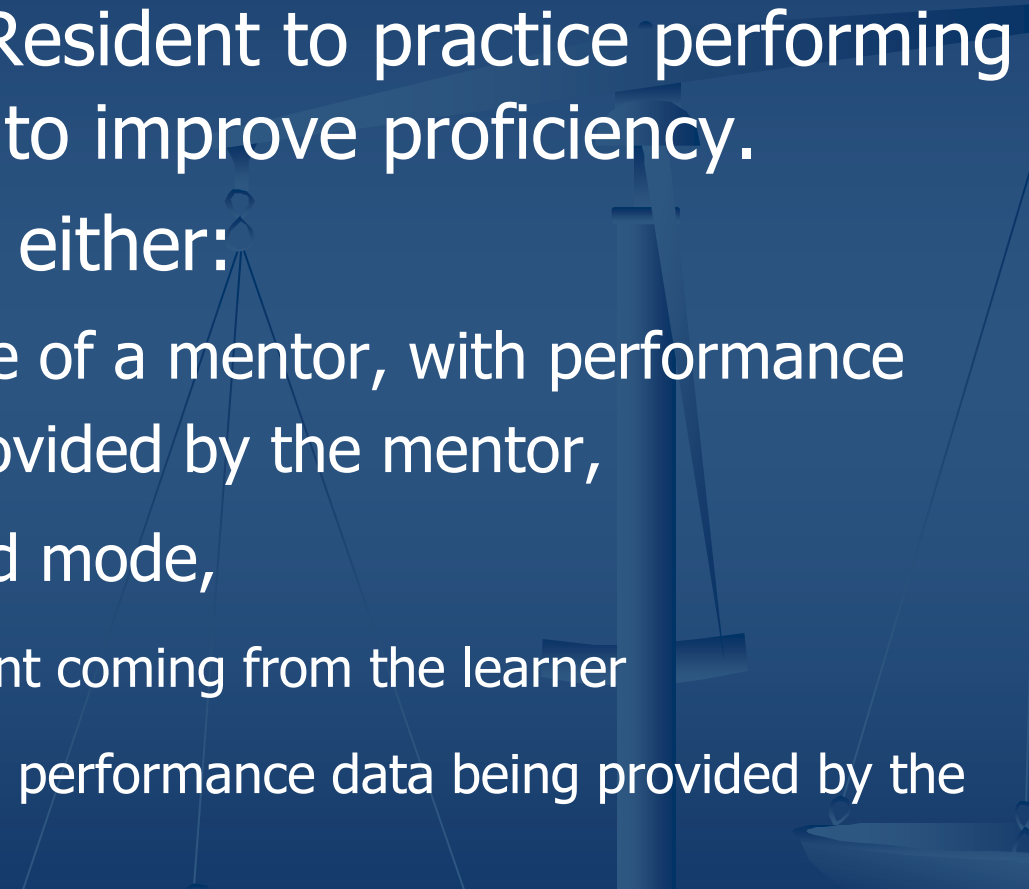


# Simbionix Real Time Dose Display

- Dose Rate/Cumulative Dose (mGy)
- Side Bar with Cumulative Dose/Dose Rate
- DAP  $\text{mGycm}^2$

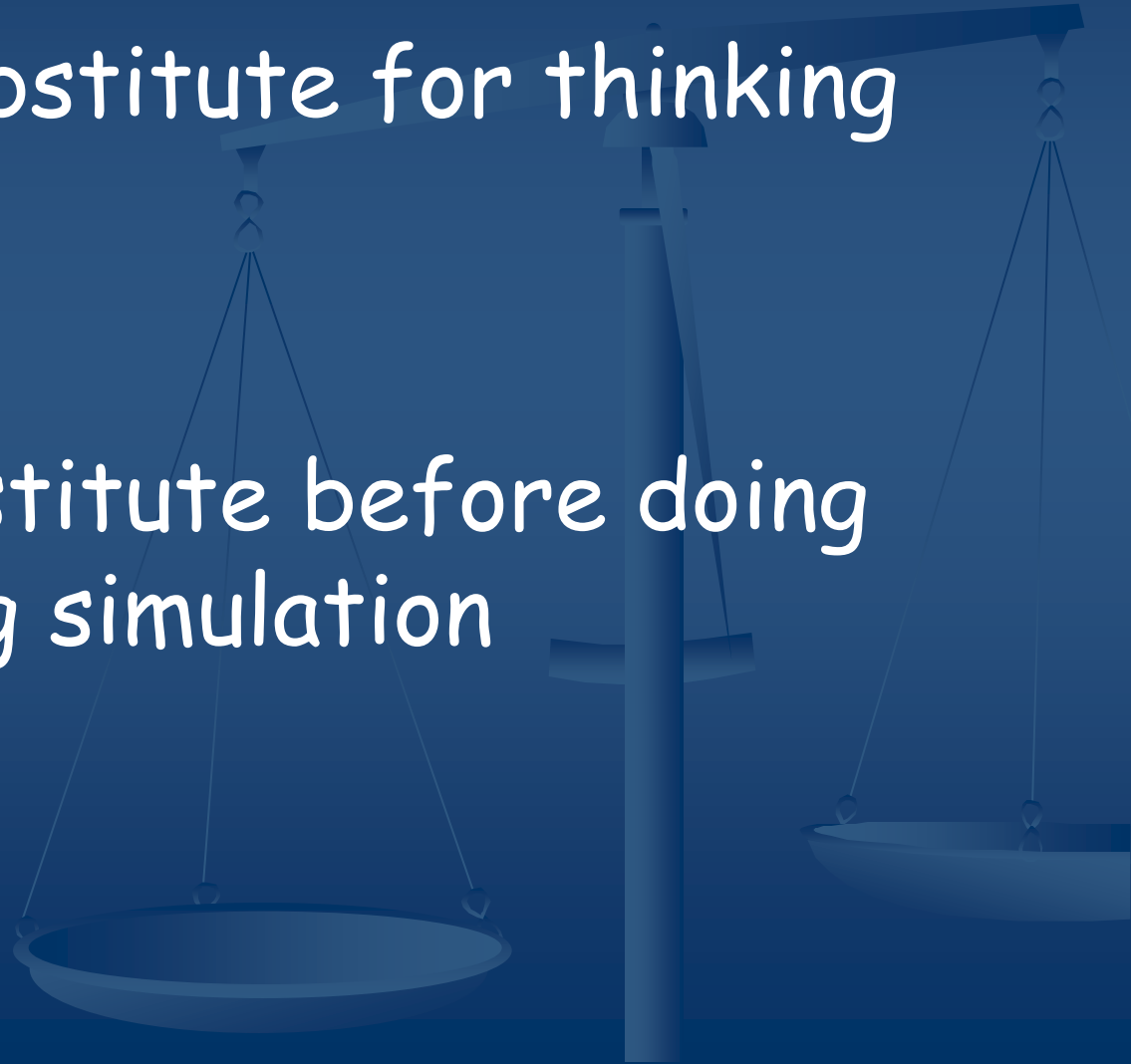


# Endovascular Community Adoption

- Medical simulation is often used as a tool to assist a Fellow or Resident to practice performing a given procedure to improve proficiency.
  - General practice is either:
    - under the guidance of a mentor, with performance feedback being provided by the mentor,
    - or in a self-directed mode,
      - with self assessment coming from the learner
      - supplemented with performance data being provided by the simulation
- 
- A faint, stylized illustration of a balance scale is visible in the background of the slide. The scale is positioned on the right side, with its vertical pillar and horizontal beam extending across the frame. The pans are visible at the bottom, though they are mostly obscured by the text and other graphical elements. The overall aesthetic is clean and professional, with a dark blue background.

# Take Home Point

- There is no substitute for thinking  
George Bakris
- Think and substitute before doing  
your case using simulation  
RPP CIRSE'15





# Thank You!

