Ask EuroSafe Imaging

Tips & Tricks

Interventional Radiology Working Group

Interventional Series – Episode 1: Radiation Dose Management

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Risks for patients

Interventional procedures are complex procedures, which can involve many risks for patients like:

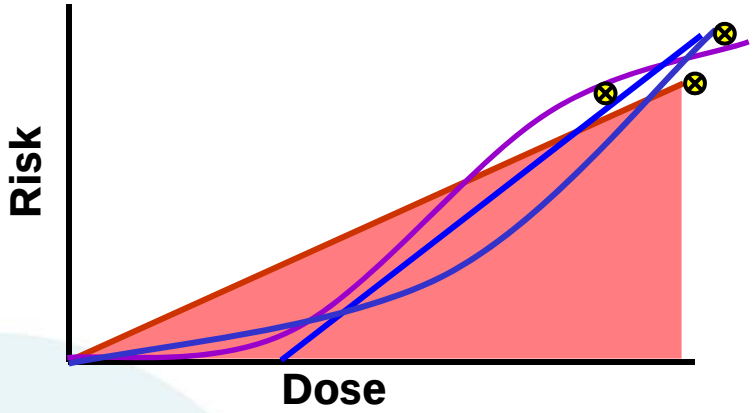
- Hematoma
- Infections
- Reaction to Contrast Agents
- …
- Death

Among these risks also the patient's exposure to ionizing radiation has to be taken into account.

Absorbed dose and possible effects

STOCHASTIC EFFECTS

- Linear - No threshold
- Other models (non linear)
- Severity independent from the dose
- Examples: cancer, genetic disease



Stochastic effects

Stochastic effect – risk increases linearly with dose.

Risk depends on:

- Volume of irradiated tissue
- Type of irradiated tissue
- Total amount of dose
- Patient age
- Genetics

Stochastic risk can be controlled → i.e: use of devices to protect healthy radiosensitive tissues.

Lately increased by the introduction of 3D techniques.

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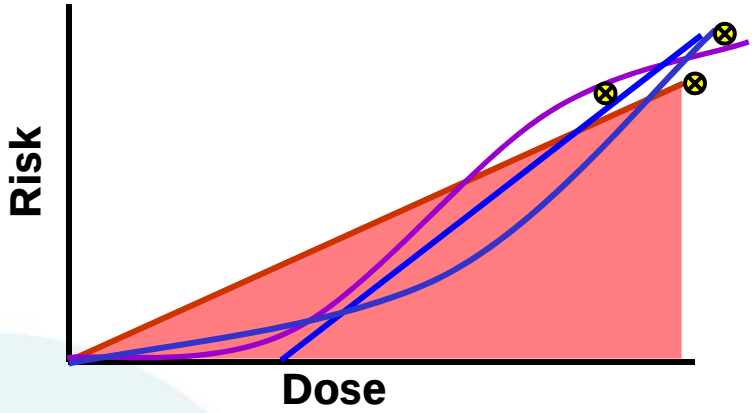
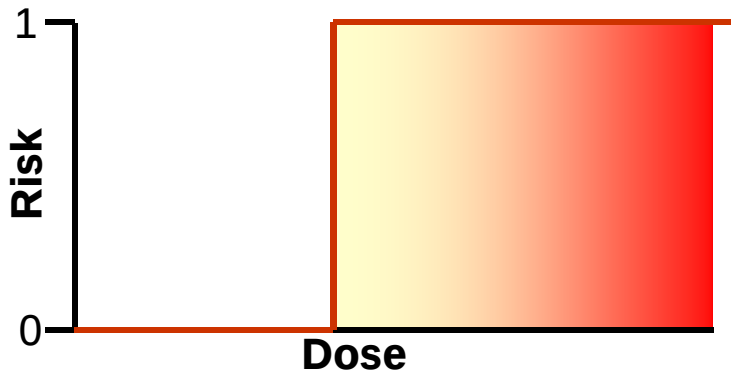


DETERMINISTIC EFFECTS

- Threshold
- Severity depends on dose
- Examples: skin injuries



Deterministic effects

Radiation skin burns represent the main risk for patients in interventional procedures.

Renal angioplasty
Dandurand et al, Ann Derm Vener 1999; 126: 413-417

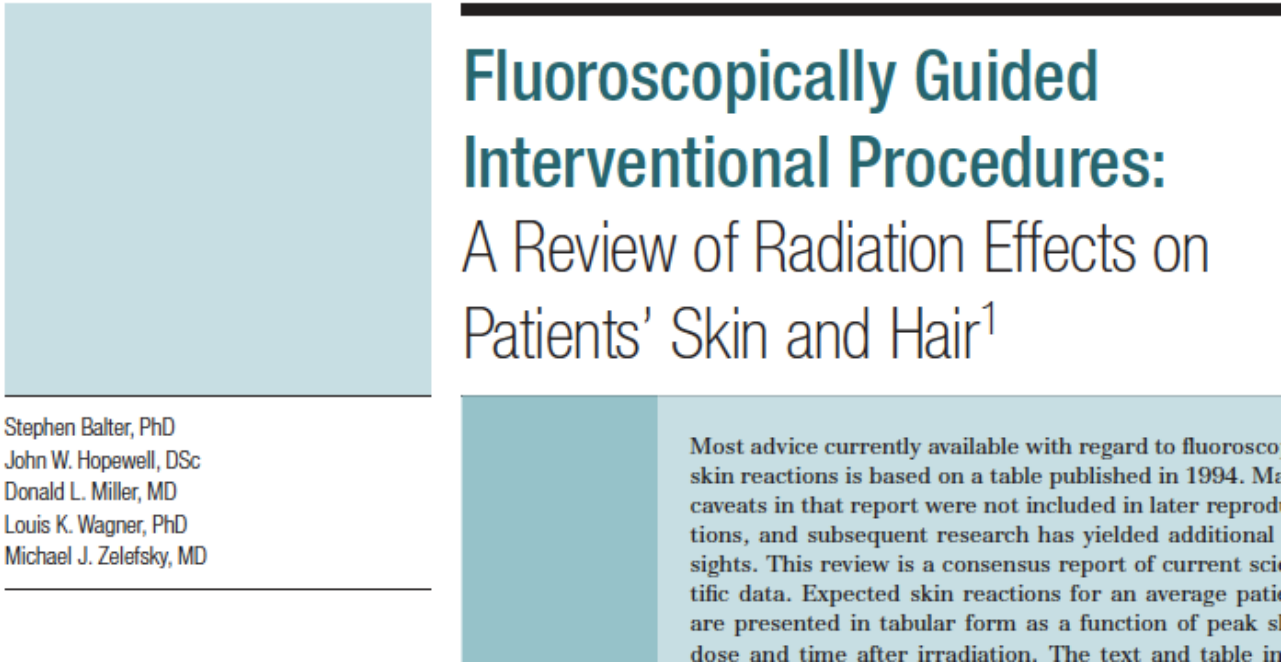
Radiofrequency Ablation
Vañó, Br J Radiol 1998; 71, 510 - 516

TIPS placement
Nahass et al, Am J Gastroent 1998; 93: 1546-9

Deterministic effects

The threshold can vary with:

- Genetic conditions
- Previous exposure
- Simultaneous treatments



Fluoroscopically Guided Interventional Procedures:
A Review of Radiation Effects on Patients' Skin and Hair[1]

Stephen Balter, PhD
John W. Hopewell, DSc
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Louis K. Wagner, PhD
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Most advice currently available with regard to fluorosco
skin reactions is based on a table published in 1994. Ma
caveats in that report were not included in later reprod
tions, and subsequent research has yielded additional
sights. This review is a consensus report of current sci
tific data. Expected skin reactions for an average pati
are presented in tabular form as a function of peak s
dose and time after irradiation. The text and table in

Management workflow

→ **Reduce** stochastic risk

→ **Prevent** tissue reactions

→ **Recognize** situations (patients) at higher risk

Three steps approach:

1. **Pre-procedure**
2. **Intra-procedure**
3. **Post-procedure**

RadioGraphics

Quality Initiatives

Establishing an Interventional Radiology Patient Radiation Safety Program

Joseph R. Steele, MD • A. Kyle Jones, PhD • Elizabeth P. Ninan, PA-C

ONLINE-ONLY CME

See www.rsna.org/education/rg_cme.html

LEARNING OBJECTIVES

After completing this journal-based CME activity, participants will be able to:

- List the radiation dose descriptors that should be recorded at the conclusion of a fluoroscopy-guided procedure.
- Describe the actions that may be taken during the three phases of a fluoroscopy-guided procedure to enhance patient safety.
- Discuss how to recognize cases that are outside the normal control limits of an interventional radiology practice.

TEACHING POINTS

See last page

The Interventional Radiology Patient Radiation Safety Program was created to better educate patients who are scheduled to undergo high-dose interventional radiologic procedures about the risks of radiation, better monitor the delivered doses, and reduce the risk for deterministic effects. The program combines preprocedure evaluation and counseling, intraprocedure monitoring, and postprocedure documentation and counseling with the guidelines of the National Cancer Institute and the Society of Interventional Radiology. Between July 2009, when the program was implemented, and September 2010, over 3500 interventional radiologic procedures were monitored and documented, and 63 procedures with an adjusted cumulative dose of more than 3 Gy were identified and further analyzed; four procedures were found to be outside the control limits. Additional review of these four procedures resulted in practice modifications. Anecdotal feedback from physician assistants and attending physicians indicated that the program had another positive effect: Patients who required postprocedure counseling about the potential for radiation-induced skin injuries were no longer surprised by this information. Implementation of this program is straightforward, requires little infrastructure and few resources, and may be applied in most interventional radiology practices. Supplemental material available at *http://radiographics.rsna.org/lookup/suppl/doi:10.1148/rg.321115002/-/DC1.*

Abbreviations: CD = cumulative dose, CD_{adj} = adjusted cumulative dose, DAP = dose-area product, RAD-IR = Radiation Doses in Interventional Radiology Procedures

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EUROPEAN SOCIETY OF RADIOLOGY

Workflow

1. Pre-procedure

- Identify risks and optimize the equipment

2. Intra-procedure

- Optimize the procedure to reduce dose
- Online dose monitoring
- Use of alert levels

3. Post-procedure

- Dose tracking
- Follow-up