Occupational radiation hazards during EVAR

FRANS MOLL
Joost van Herwaarden
Quirina de Ruiter
Risks of the radiation

**Deterministic risks**
- Threshold dose
- Short term

Threshold 2 Gy

**Stochastic risks**
- Damage to DNA
- Latency time
- Long term
The Hybrid OR
Fluoroscopy time (FT, min)
Time ≠ Dose!
DAP

Dose Kerma

Area

Product

Gy * cm²

1 Gray = 1 Joule kilogram
Predictors of high Radiation doses
(1) Type Procedure:

<table>
<thead>
<tr>
<th>noncomplex</th>
<th>EVAR</th>
<th>complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-20 min (10-30)</td>
<td>Fluoroscopy time</td>
<td>80 min (50-200)</td>
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</tbody>
</table>
(2) Equipment:
Mobile C-arm vs Fixed C-arm vs Fixed with Clarity
(3) Fluororscopy vs Angiografie

Major increase in radiation doses during DSA!
(4) BMI
(4) BMI

Each 10 cm of tissue, **Doubles** the radiation dose
For similar image quality!
(5) C-arm Angulation

- **LAT**
- **PA**
- **oblique**
(5) C-arm Angulation

- AO: 1°
- 0°
- Height (cm): +1
- SID (cm): 105
- FD (cm): 48
- DETECTOR bodyguard override: unknown
- Exposure (exp): 2
- Fluoroscopy (fluoro): Low
- Time: 31:25
- K: 0.12 mGy/s
- DAP: 34.2 mGy cm²/s

34 mGy cm²/s
(5) C-arm Angulation

DAP from 34 → 66mGycm²/s
Editor’s Choice — Angulation of the C-Arm During Complex Endovascular Aortic Procedures Increases Radiation Exposure to the Head

M.A. Albayati a, S. Kelly a, D. Gallagher b, R. Dourado c, A.S. Patel a, P. Saha a, A. Bajwa a, T. El-Sayed a, R. Salter c, P. Gkoutzios c, T. Carrell a, S. Abisi a, B. Modarai a,∗

a Academic Department of Vascular Surgery, Cardiovascular Division, King’s College London, BHF Centre of Research Excellence & NIHR Biomedical Research Centre at King’s Health Partners, St Thomas’ Hospital, London, UK
b Department of Medical Physics, Guy’s & St Thomas’ NHS Foundation Trust, London, UK
c Department of Interventional Radiology, Guy’s & St Thomas’ NHS Foundation Trust, London, UK
How can we **reduce** the intra-operative radiation dose?
(A) Collimation
Collimation!!

DAP from 41 → 14 mGycm²/s
(B) Lowest Fluoroscopy Protocol
Fluoroscopy protocol:
(1) Low

DAP 59 mGy cm²/s
Fluoroscopy protocol:
(1) Low $\rightarrow$ (2) medium

DAP from 59 $\rightarrow$ 109 mGy cm$^2$/s
Minimize the Air Gap

Source-to-Image Distance (SID)

90 cm
SID: Source to image Distance → AIR Gap

Time 431 min
SID: 109 → 102 cm
431 → 479 minutes
(D) Taking Distance!
(D) Stand next to each other
(E) Lead flaps at the table
(F) Ceiling mounted lead screens
Use of Disposable Radiation-absorbing Surgical Drapes Results in Significant Dose Reduction During EVAR Procedures

C. Kloeze a, E.G. Klompenhouwer b, P.J.M. Brands a, M.R.H.M. van Sambeek c, P.W.M. Cuypers c, J.A.W. Teijink c,d,*

a Department of Medical Physics, ICMT, Catharina Hospital, Eindhoven, The Netherlands
b Department of Radiology, Catharina Hospital, Eindhoven, The Netherlands
c Department of Vascular Surgery, Catharina Hospital, Eindhoven, The Netherlands
d Department of Epidemiology, CAPHRI Research School, Maastricht University, Maastricht, The Netherlands

WHAT THIS PAPER ADDS
Because of the increasing number of endovascular procedures with fluoroscopy, the corresponding high annual dose for interventionalists, and the European directive (ICRP 2011) requiring a lower annual radiation dose to the eye lens, additional dose-protecting measures are desirable for all operating staff during endovascular aneurysm repair (EVAR). The effect of disposable radiation-absorbing surgical drapes has never been studied before in a randomized controlled setting during endovascular procedures for AAA repair. This study evaluates the effect of these drapes on the annual dose to the interventionalist and supporting staff.
(g) Lead absorbing sterile blanket
## Summary Predictors of Radiation

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<th>Low Radiation</th>
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<td>(1) Complexity of the EVAR</td>
<td>(1) Collimation</td>
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<td>(5) C-arm Angulation</td>
<td>(7) Dose Awareness</td>
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Vragen
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