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TURIN
October
24th-26th
2019

Health risks for interventional cardiologist

Malcolm R. Bell, MBBS, FRACP
Vice Chair, Department of CV Medicine
Mayo Clinic, Rochester, MN

Conflicts and disclosures – none

Search ●●●○○ LTE 9:37 AM 93%

Tweet

Rajiv Gulati
@rajivxgulati

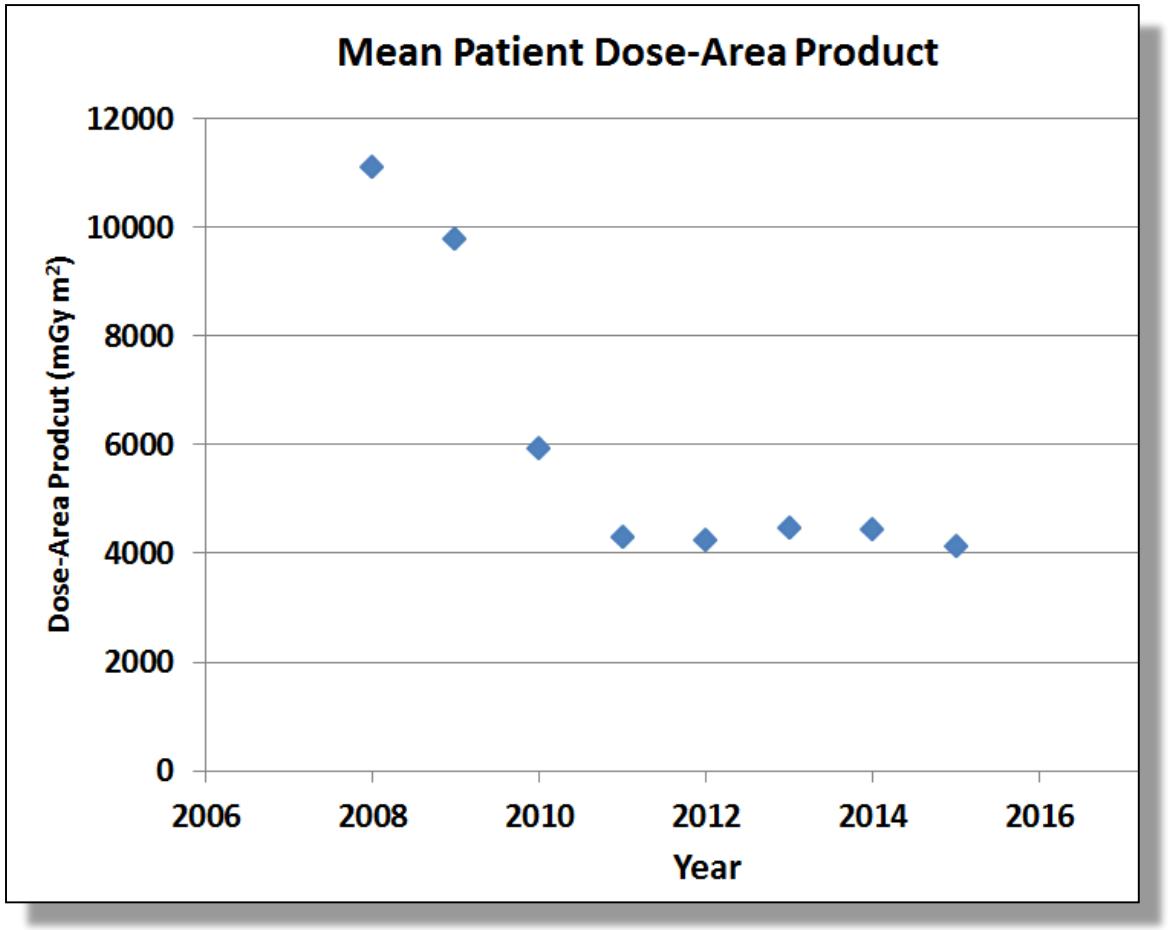
Which occupational hazard worries you more?
@DrSheilaSahni @chadialraies @CardiacConsult @willsuh76 @SVRaoMD @rwyeh @KaulP #RadialFirst #CTO

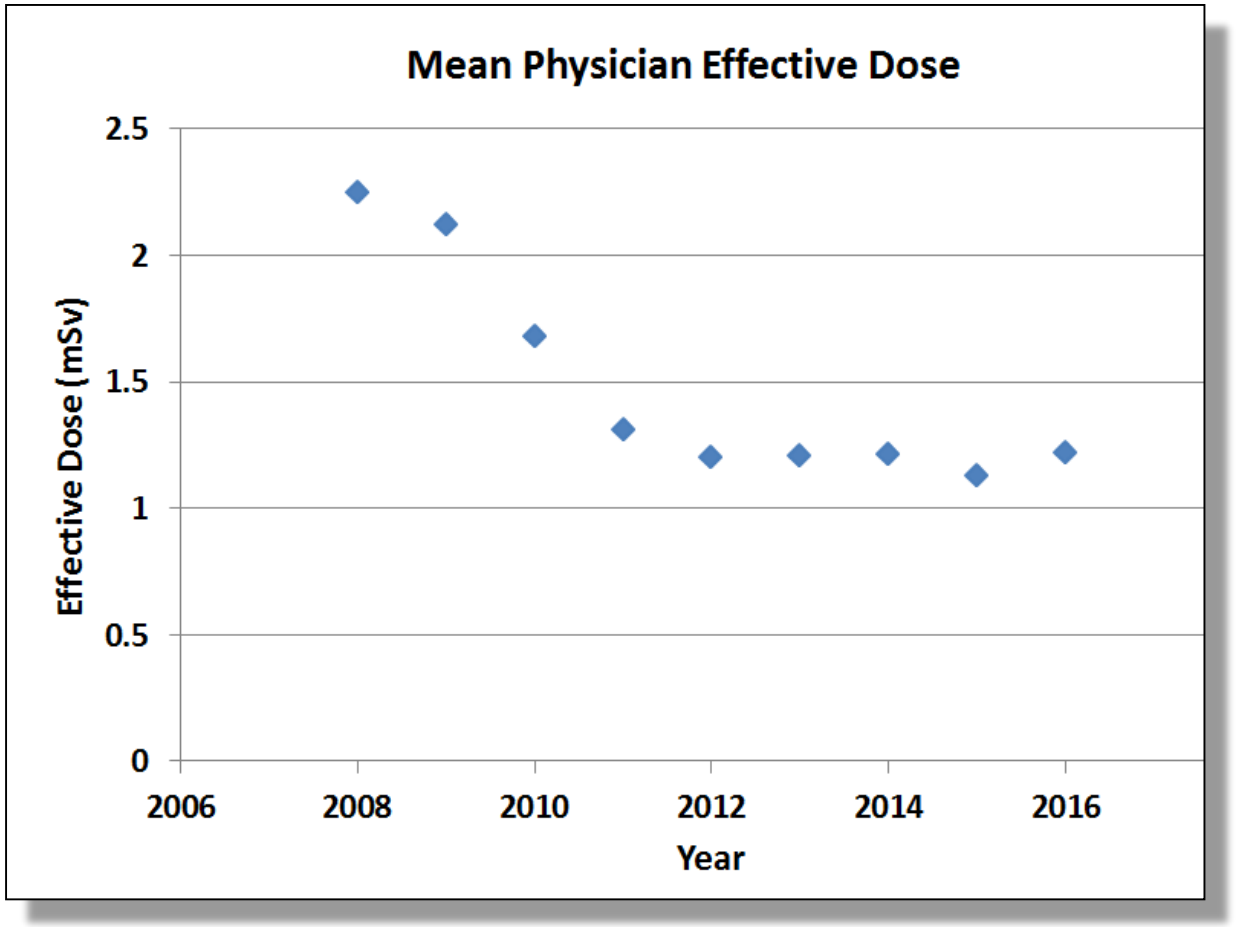
Radiation	57%
Orthopedic	22%
Both equal	21%

184 votes • Final results

5/7/17, 11:49 AM

Radiation dose reduction at Mayo Clinic

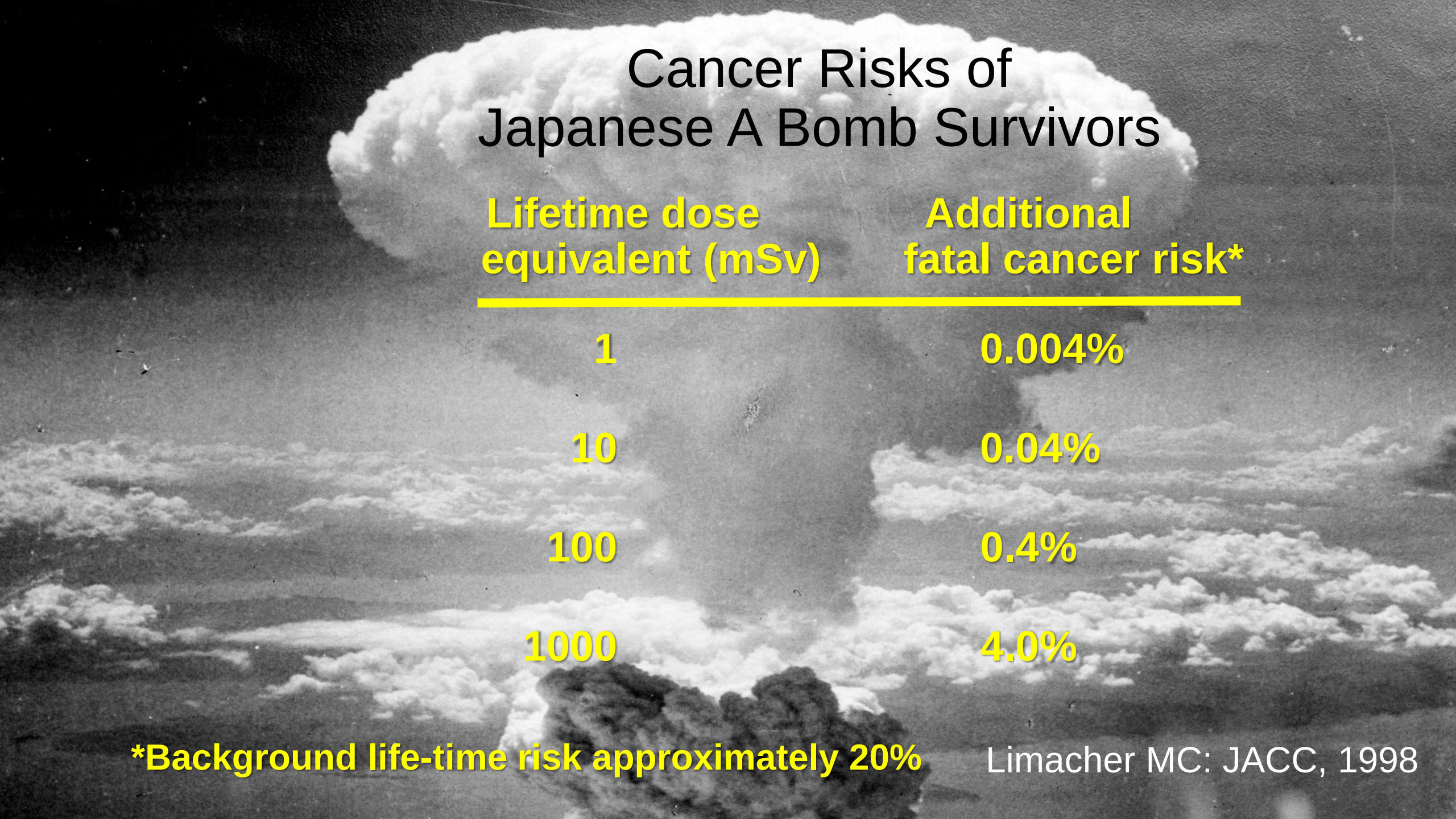




Courtesy - Fetterly K: 2017

Radiation Dose (mrem) For Quarter Ending				01/01/2016 to 12/31/2016	
03/31/2016	06/30/2016	09/30/2016	12/31/2016	Total (mrem)	Effective Dose Equivalent (mrem)
180	150	120	60	510	91
110	90	90	120	410	73
240	190	800	400	1,630	291
70	30	80	50	230	41
140	40	100	180	460	82
230	290	340	210	1,070	191
80	50	200	40	370	66
0	0	0	0	0	0
210	220	170	170	770	138
130	130	210	150	620	111
260	320	420	360	1,360	243
100	780	400	610	1,890	338
0	40	160	90	290	52
270	330	750	410	1,760	314
40	40	60	10	150	27
60	80	100	70	310	55
80	250	140	70	540	96
			440	440	79
170	240	280	250	940	168
180	160	340	150	830	148
70	60	110	60	300	54
230	270	500	400	1,400	250
20	40	70	0	130	23
10	80	30	0	120	21
160	40	190	210	600	107
		Workgroup Mean Dose (25 people)		685	122

2.9 mSv



Cancer Risks of Japanese A Bomb Survivors

Lifetime dose equivalent (mSv)	Additional fatal cancer risk*
1	0.004%
10	0.04%
100	0.4%
1000	4.0%

*Background life-time risk approximately 20%

Limacher MC: JACC, 1998

Brain and Neck Tumors Among Physicians Performing Interventional Procedures

Ariel Roguin, MD, PhD[a,*], Jacob Goldstein, MD[b], Olivier Bar, MD[c], and James A. Goldstein, MD[d]

Physicians performing interventional procedures are chronically exposed to ionizing radiation, which is known to pose increased cancer risks. We recently reported 9 cases of brain cancer in interventional cardiologists. Subsequently, we received 22 additional cases from around the world, comprising an expanded 31 case cohort. Data were transmitted to us during the past few months. For all cases, where possible, we endeavored to obtain the baseline data, including age, gender, tumor type, and side involved, specialty (cardiologist vs radiologist), and number of years in practice. These data were obtained from the medical records, interviews with patients, when possible, or with family members and/or colleagues. The present report documented brain and neck tumors occurring in 31 physicians: 23 interventional cardiologists, 2 electrophysiologists, and 6 interventional radiologists. All

….disproportionate reports of left-sided tumors suggest the possibility of a causal relation to occupational radiation exposure….

more exposed to radiation than the right, these findings of disproportionate reports of left-sided tumors suggest the possibility of a causal relation to occupational radiation exposure. (Am J Cardiol 2013;111:1368–1372)

Roguin A: Am J Cardiol 2013

Brain tumors and radiation

Radiation therapy (2 Sv) linked to meningiomas

Low weighting factor for brain (0.01) - dose attenuation

Thick skull!

Interventional cardiologist head receives 20-30 mSv per year, with use of ceiling-screen:

Lifetime exposure to the head may approach 1 Sv

Picano E: BMC Cancer 2012

Estimates of brain dose - 30 yrs in cath lab

Mayo Clinic estimate of 120 mSv per lifetime*

- Represents incremental risk of 0.04%
- Among 10,000 interventional cardiologists, fatal brain tumors will occur in:
  - 25 from natural incidence
  - 4 from occupational exposure

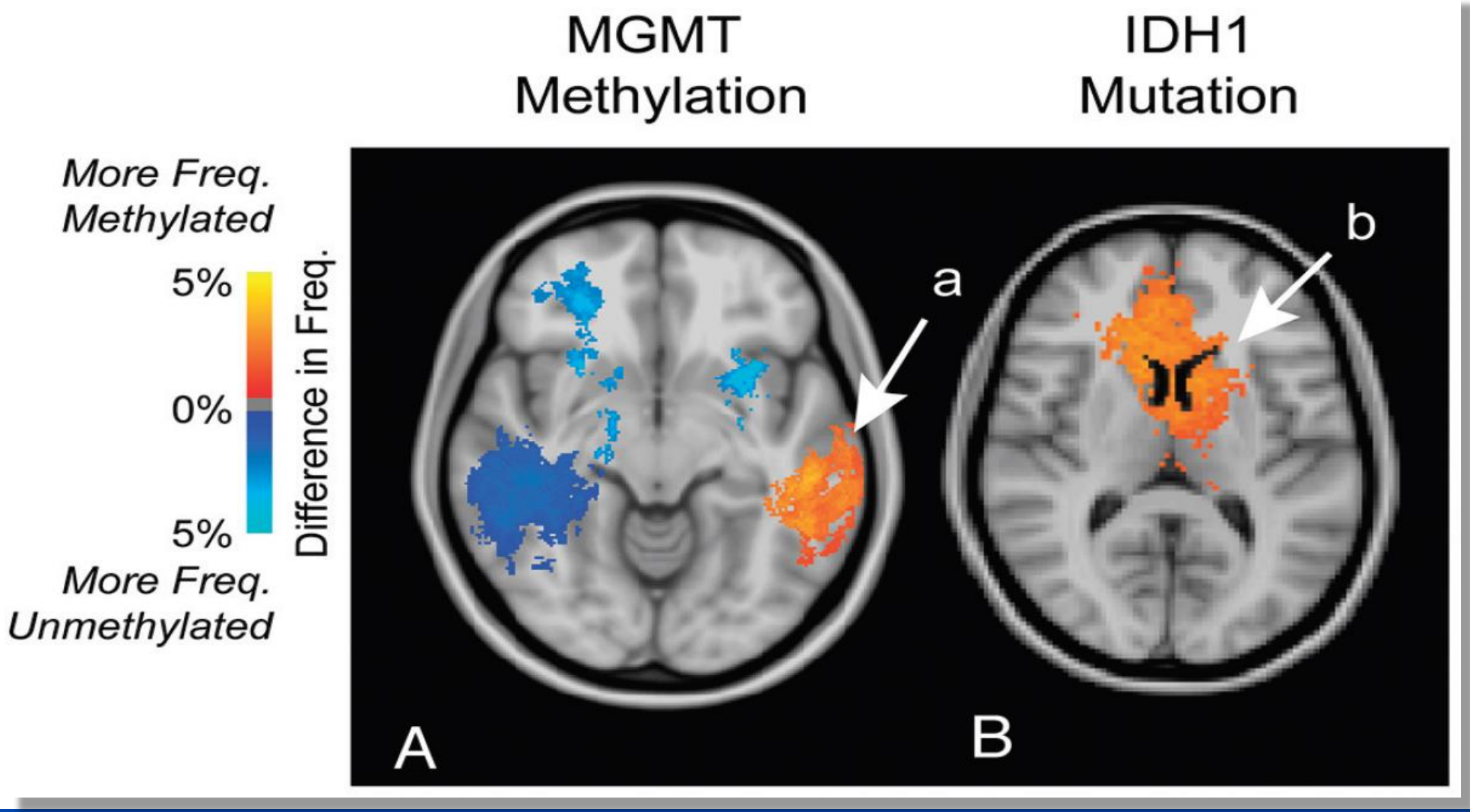
Other estimates of 0.06 µSv per case**

- Need to do 2.5 million cases to be at risk

MAYO CLINIC

*Fetterly K: JACC Interv 2017
**Marsh RM: JACC Interv 2016

Asymmetry in brain tumors



Ellingson BM: American Journal of Neuroradiology March 2013, 34 (3) 533-540

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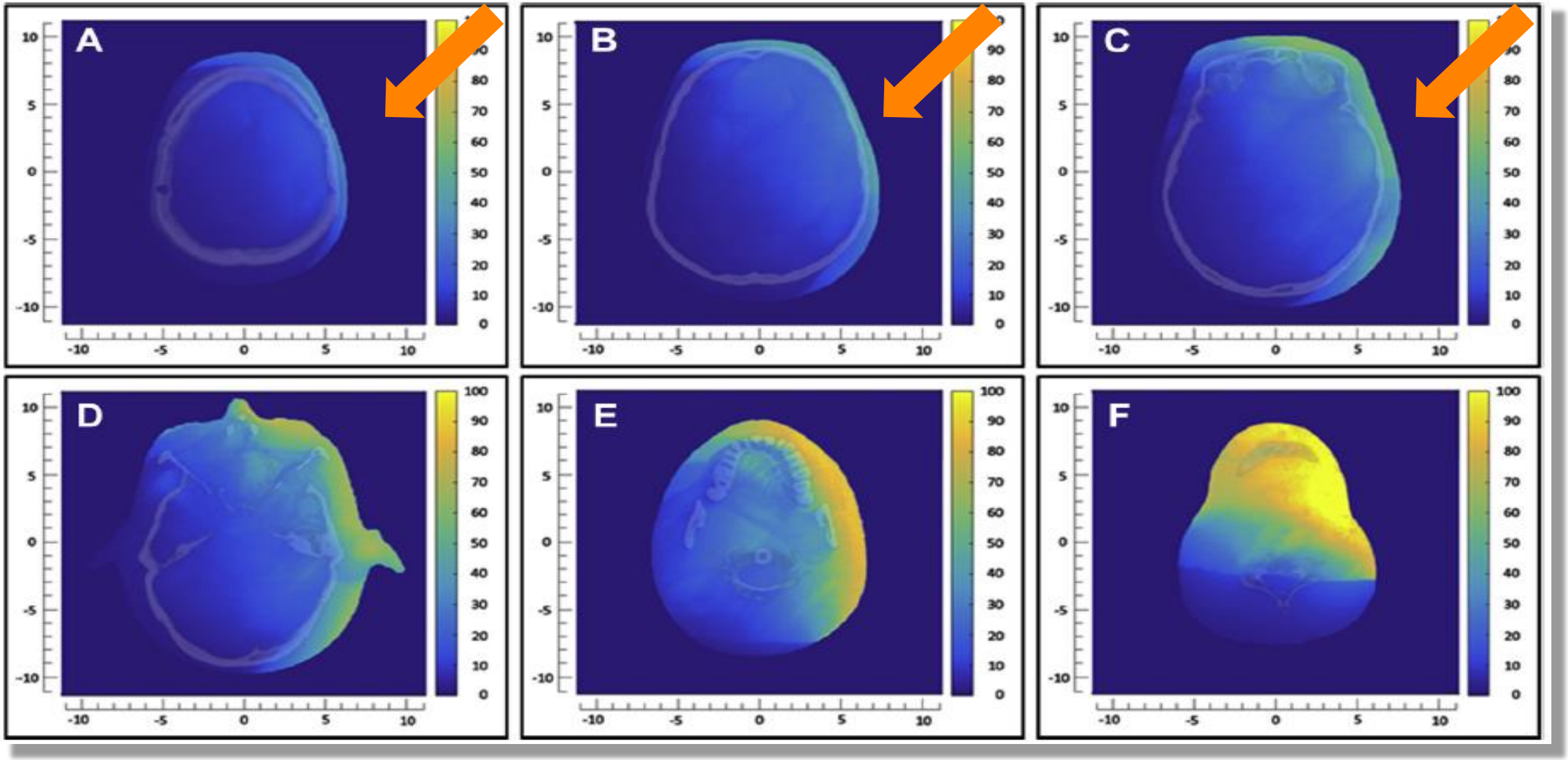
RADIATION SAFETY

Head and Neck Radiation Dose and Radiation Safety for Interventional Physicians

Kenneth Fetterly, PhD,[a] Beth Schueler, PhD,[b] Michael Grams, PhD,[c] Glenn Sturchio, PhD,[d] Malcolm Bell, MD,[a] Rajiv Gulati, MD[a]


A
B
C
D
E
F



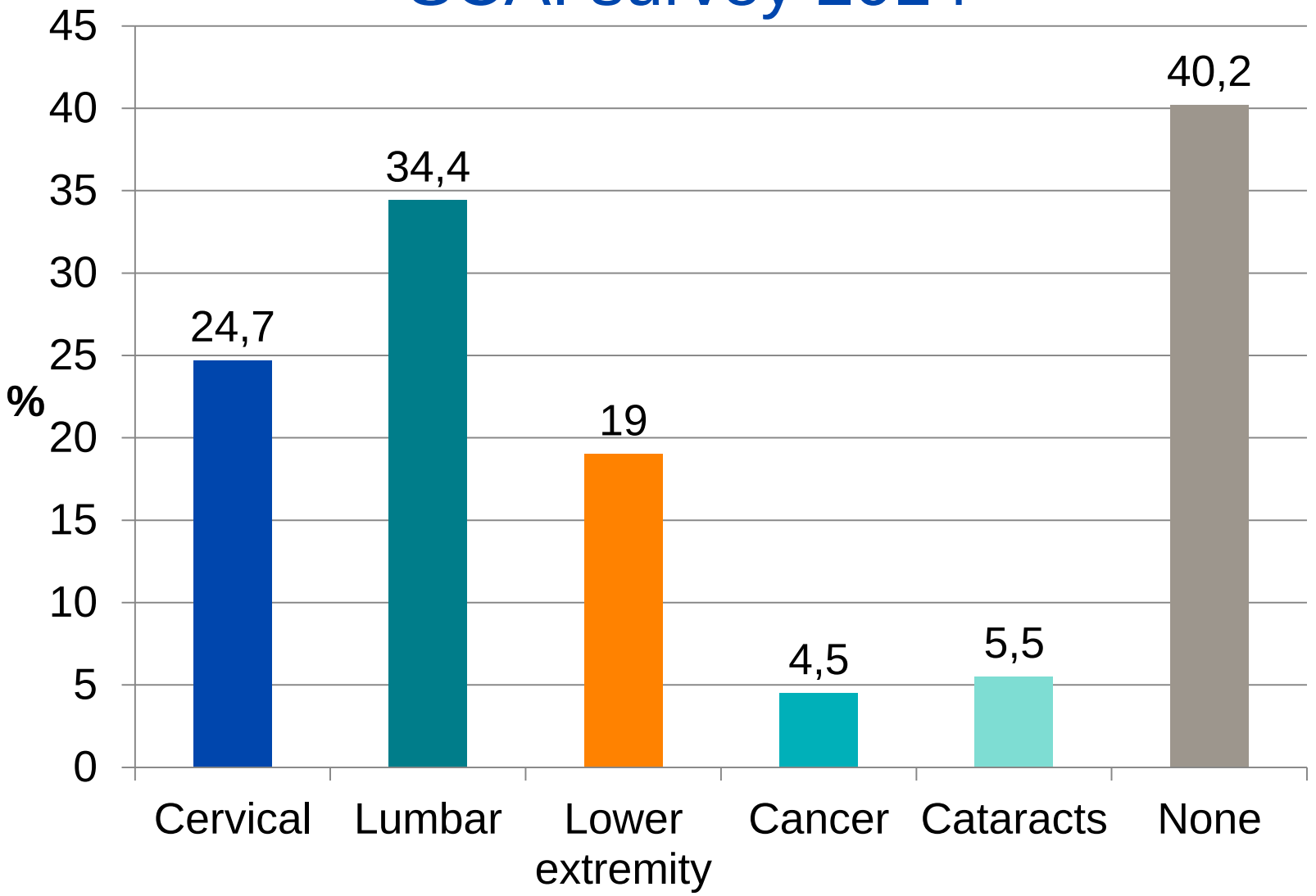
Fetterly K: JACC Intv 2017

Protection from radiation comes, literally, with a heavy tax burden

“Interventionalist’s disc disease is a confirmed entity”

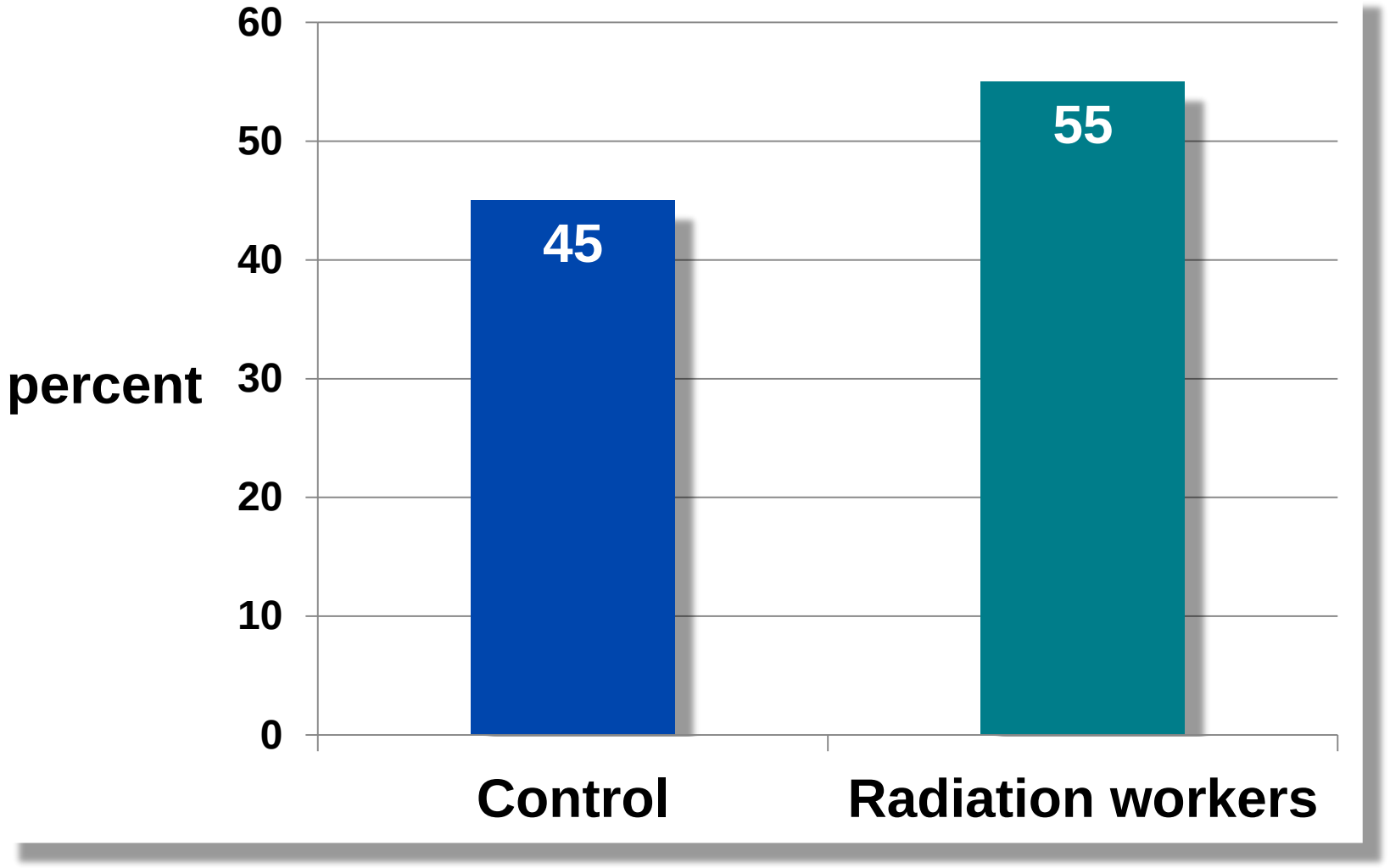
Ross AM: Am J Cardiol 1997

SCAI survey 2014



Klein LW: Cathet Cardiovasc Intv 2015

Work-related musculoskeletal pain: Mayo Clinic



Orme N: JACC 2015

30% prevalence of low back pain (LBP)

80% will experience during their life

Chronic LBP in 10%

Adult incidence 5% per year peaking 35-55 yrs

“Top 10” in 2010 Global Burden of Disease study*

*Lancet 2012

Bad ergonomics in the cath lab?

Increasingly long procedures

Prolonged standing, awkward positions, bending, reaching, turning and twisting

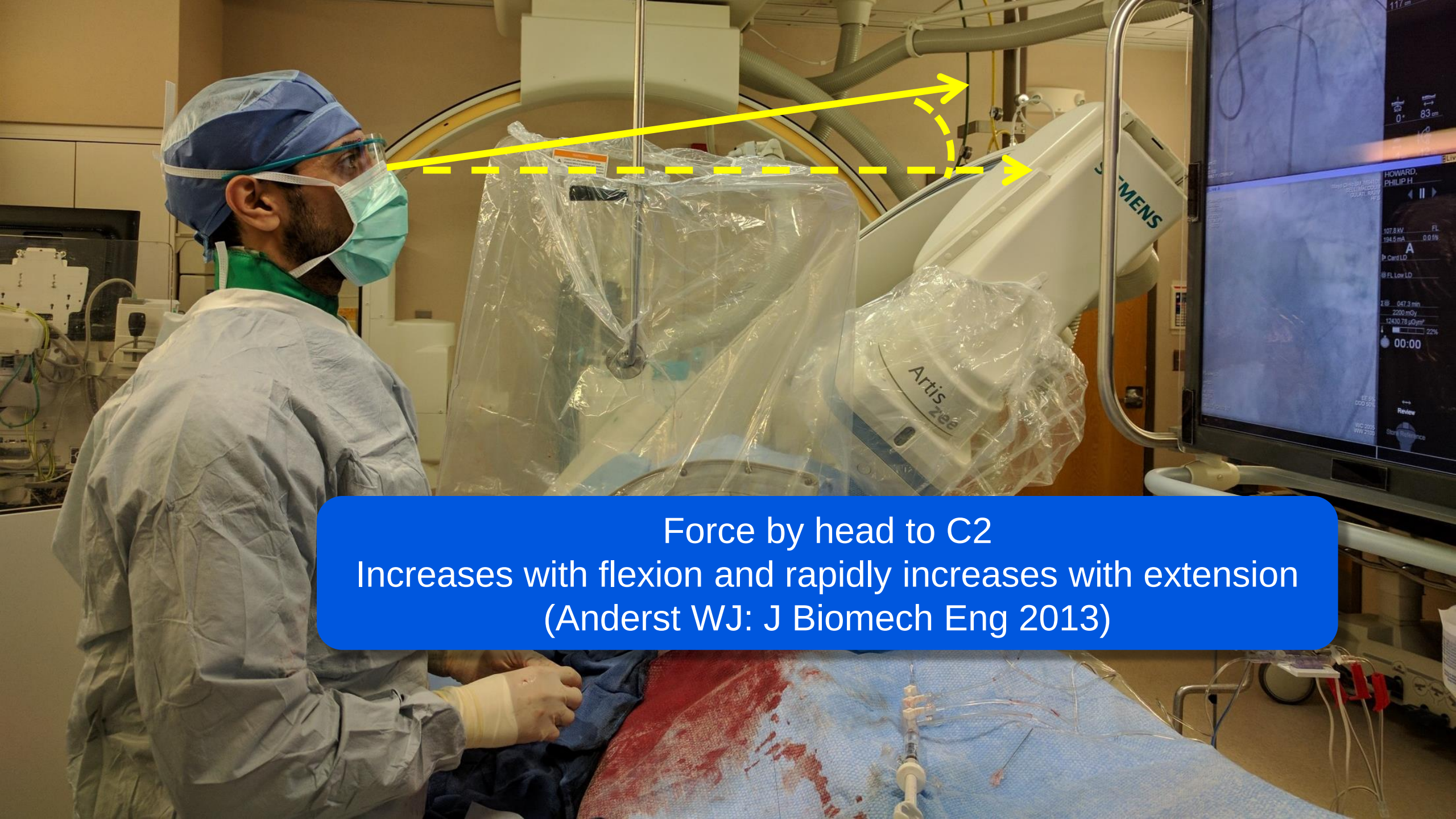
Moving equipment – foot pedal, panning (heavy patients)

Heavy protective apron and glasses

Monitor not always in direct line of sight

Muscle tension


Spurling’s test to diagnose cervical neuropathy
2000 kPa on vertebral disks



Force by head to C2
Increases with flexion and rapidly increases with extension
(Anderst WJ: J Biomech Eng 2013)

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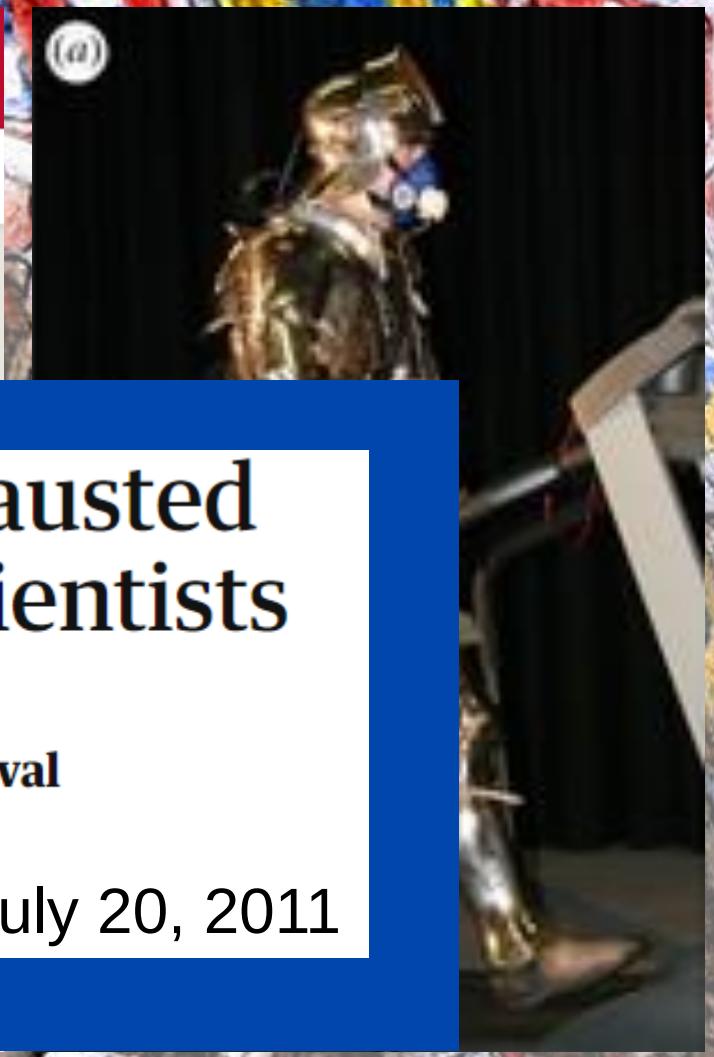
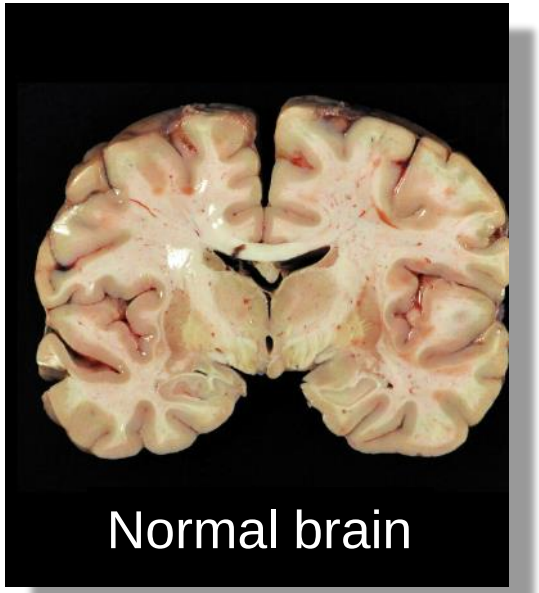


Heavy armour would have exhausted the French at Agincourt, say scientists

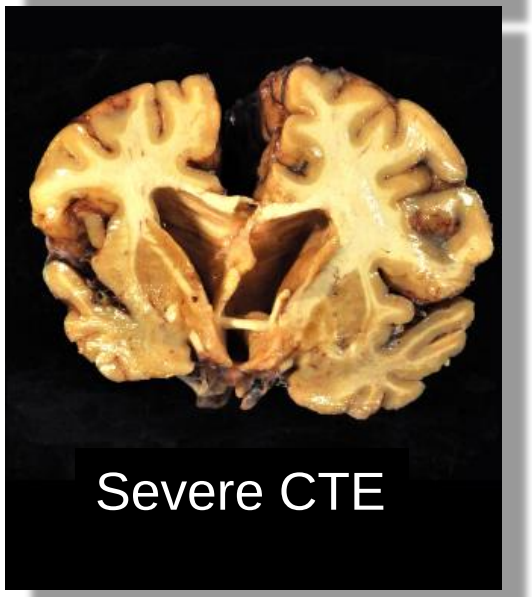
Tests involving volunteers running on a treadmill in medieval armour suggest the French were too knackered to fight

The Guardian July 20, 2011

MAYO CLINIC



Normal brain

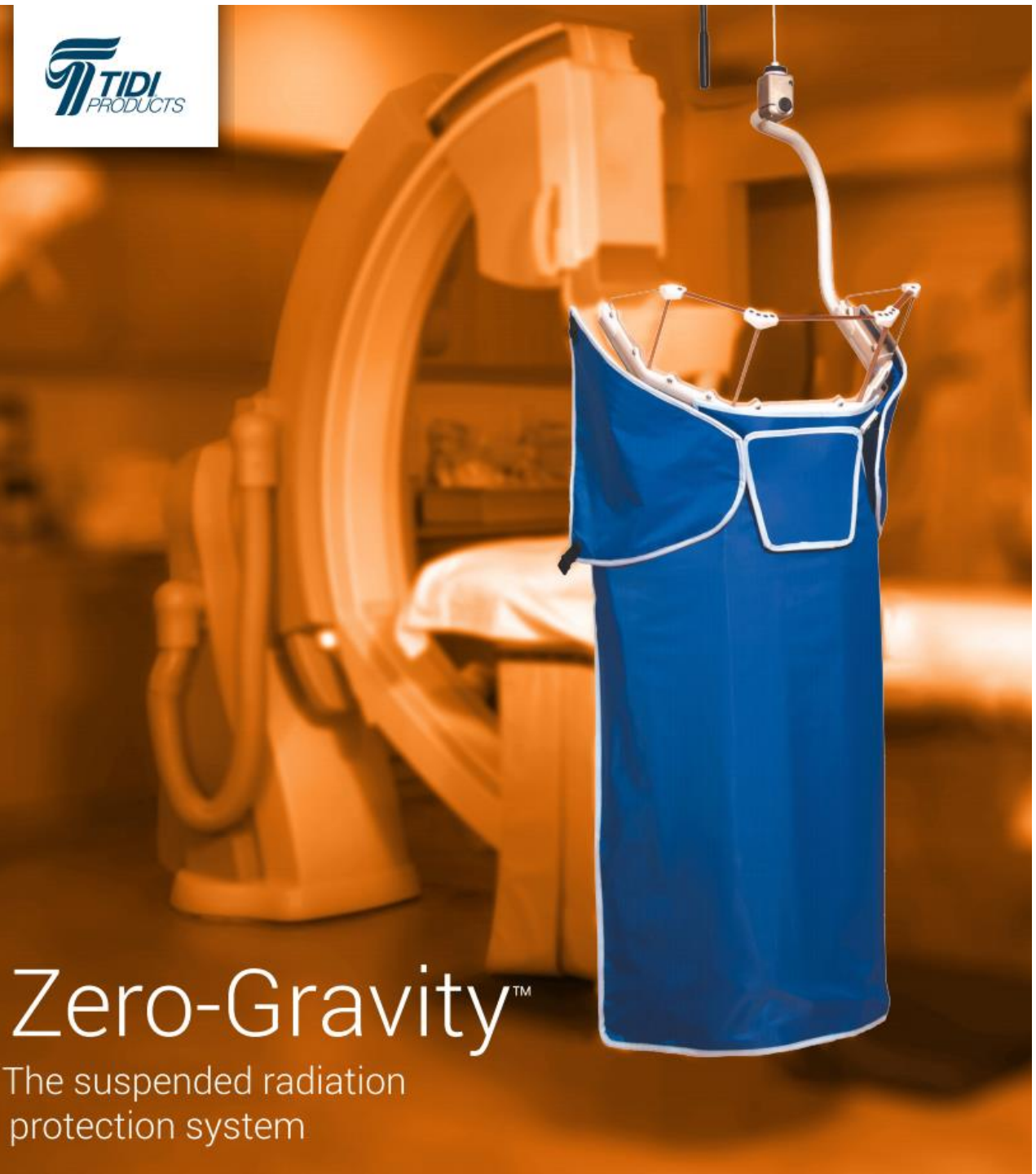


Severe CTE

MAYO CLINIC

Zero Gravity

virgin.com



Open Journal of Radiology, 2013, 3, 143-151
http://dx.doi.org/10.4236/ojrad.2013.33024 Published Online September 2013 (http://www.scirp.org/journal/ojrad)
Scientific Research

Evaluation of a Suspended Personal Radiation Protection System vs. Conventional Apron and Shields in Clinical Interventional Procedures

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ABSTRACT

Purpose: This clinical study compares conventional lead aprons and ancillary shields to a functionally weightless personal overhead-supported system with expanded coverage. **Materials and Methods:** Primary operators performed procedures (N = 126, fluoroscopy minutes = 1209) using one of 2 methods of radiation protection and wearing dosimeters on multiple body locations. Method "LAS" (Lead-Apron+Shields): lead skirt, vest, thyroid shield, with 100% use of under-table shield, side shield, and mobile suspended lead-acrylic shield. Method "Zgrav": ZeroGravity system (CFI Medical Solutions) with variable use of shielding. The studied early model moving with the operator had a curved lead-acrylic head shield (0.5 mm Pb) and expansive lead apron (0.5 - 1.0 mm Pb) that covered leg to distal calf and proximal arm to elbow, and a drape that permitted sterile entry and exit. Study was institutional review board approved and HIPPA-compliant. **Results:** Measured with a sensitive electronic dosimeter, eye exposures were 99% ($P < 0.001$) reduced for Zgrav with upgraded face shield vs. LAS, regardless of use or non-use of suspended shield with Zgrav. With optically stimulated luminescence (OSL) dosimeters, operator exposures, standardized to minutes of fluoroscopy and Fluoroscopic Patient Dose Area Product, were reduced by 87% - 100% for eye & head, neck, humerus, and tibia (Zgrav vs. LAS). Overall eye & head exposure reduction for entire study was 94%. Non-equivalence of torso exposures was not demonstrated. A brief user survey showed ergonomic advantages of Zgrav. **Conclusion:** Compared to conventional lead aprons with shields, the suspended system provided superior operator protection during interventional fluoroscopy, allowing operators to perform procedures without potentially obstructive shields.




Savage C: Open Journal of Radiology 2013


SIEMENS
81.0 kV
207.5 mA
A
Card LD
FL Low LD
005.9 min
221 mGy
25 mGy/min
00:00
Review
Store Reference
BARCO
Corindus

Conclusions

Serious health hazards in the cath lab still exist

Call to action to prevent work-related health injury and disease

- Individual, institutional, professional societies, industry

High quality research in this area long overdue

Balancing perceived and real risks with joy of work and the service to our patients

Avoid curtailment of our careers and make them more comfortable

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