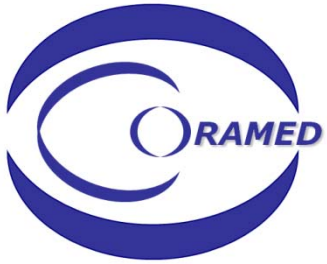


EXTREMITY DOSIMETRY IN INTERVENTIONAL RADIOLOGY AND CARDIOLOGY

CORRELATIONS AND EXTRAPOLATIONS TO ANNUAL DOSES

Krim S., Carinou E., Brodecki M.,Domienik J., Donadille L., Ferrari P., Jankowski J., Koukorava C., Nikodemova D., Ruiz-Lopez N., Sans Merce M., Struelens L.,Vanhavere F.

CORRELATIONS EXTREMITY DOSES

1 - Correlations extremity doses with KAP ?

Eyes
Fingers
Wrists
Legs

?

KAP µGy.m²

X-Ray

2 - Correlations between extremity doses

Eyes
Fingers
Wrists
Legs

?

Eyes
Fingers
Wrists
Legs

Which cases ?

- type of shielding used
- tube configurations
- Access
- Type of procedures

Correlations Extremity doses

Introduction to correlations

In statistics, **Pearson product-moment correlation coefficient** "r"is a measure of the correlation between two variables *X* and *Y*, giving a value between +1 and −1 inclusive.

Value of r	Interpretation
r= 0	The two variables do not vary together at all.
0 < r < 1	The two variables tend to increase or decrease together.
r = 1.0	Perfect correlation.
-1 < r < 0	One variable increases as the other decreases.
r = -1.0	Perfect negative or inverse correlation.

Correlations Extremity doses

Introduction to correlations

If r is far from zero, 3 possible explanations:

- The X variable helps determine the value of the Y variable.
- The Y variable helps determine the value of the X variable.
- X and Y don't really correlate at all, observation of such a correlation by chance. The P value determines how often this could occur.

Correlations Extremity doses

Introduction to correlations : In practice

- P value with 95% confidence
  - If P value < 0.05 : the correlation is not a coincidence.
  - If the P value is larger : no reason to conclude that the correlation is real (no compelling evidence that the correlation is real and not a coincidence)
- r^2 values

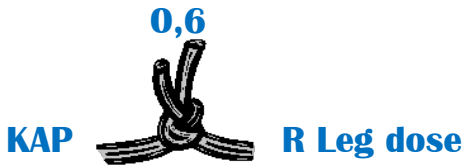
Value of r^2	Interpretation
$0.3 < r^2 < 0.5$	Poor correlation between X and Y : 30 to 50% variance in X can be explained by variation in Y (and vice versa)
$0.5 \leq r^2 \leq 0.7$	Good correlation between X and Y : 50 to 70% variance in X can be explained by variation in Y (and vice versa)
$0.7 < r^2 \leq 1.0$	Excellent correlation between X and Y : 70 to 100% variance in X can be explained by variation in Y (and vice versa)

Correlations Extremity doses
All procedures : Legs & KAP

- **No table shield**, femoral access :
  - Tube below (n=82)
  - Tube biplane (n=23)

- **Table shield,** Femoral access:
  - Tube biplane (n=38)

- **Table shield**, Shoulder access
  - Tube below (n=33)



Correlations Extremity doses
All procedures : Eyes & KAP

- Tube **below**
  - No ceiling (n=671)
  - Ceiling (n=336)

- **Biplane** tubes
  - No ceiling (n=33)
  - Ceiling (n=31)

- Tube **above**

No ceiling (n=93)

Ceiling (n=32)

Correlations Extremity doses
All procedures : Wrists & KAP

No ceiling shield

- **Femoral access**
  - tube above n=38
  - biplane tubes n=15
- **Shoulder access**
  - Tube below n=107
  - Tube above n=10

Correlations Extremity doses
Conclusion 1

Knowing the KAP µGy.m²

Possibility to estimate the dose to the eyes

No ceiling shield & tube above
(i.e : ERCP procedures)

Possibility to estimate the dose to the Left wrist

Only when no ceiling shield

CORRELATIONS EXTREMITY DOSES
CONCLUSION 2

Knowing the KAP µGy.m²

X-Ray

Possibility to estimate the dose to the R LEG

When a table shield is used

Possibility to estimate the dose to the L LEG

When there is no table shield

Ex : ERCP and embolisations

Correlations Extremity doses

All procedures : Fingers & Wrists

- **No ceiling** * n=705

- **Ceiling** n=463

Access shoulder n=109

i.e. : PM/ICD

Correlations Extremity doses
All procedures : Eyes & Hands

No ceiling

- Tube **below** n=573

  Ex : PM Implantations

  M Eye & L Finger r^2~0,8

- **Biplane** tubes n=19

Using ceiling shield

- **Biplane** tubes n=16

?

?

- Tube **above** n=37

CORRELATIONS EXTREMITY DOSES

CONCLUSION 3

Knowing the dose to the left finger

Possibility to estimate the dose to the L/R eye

No ceiling shield & tube below

CORRELATIONS EXTREMITY DOSES

CONCLUSION 4

Knowing the dose to the left wrist

Possibility to estimate the dose to the left finger

No ceiling shield i.e : IC

Ceiling shield & shoulder access (typically PM implantations)

Possibility to estimate the dose to the L/R eye

Ceiling shield and tube above

Correlations Extremity doses

Summary

General correlations difficult to find

Only when certain conditions are gathered

Legs & KAP :

No table shield & Femoral access & Tube below

Eyes & KAP :

Tube above & No ceiling

Hands & KAP :

No ceiling shield & Femoral access & Tube above

No ceiling shield & Shoulder access & Tube below

It is the responsability of the RP officer to ensure that these conditions are met before calculating….

Correlations Extremity doses

Summary

General correlations difficult to find

Only when certain conditions are gathered

Eyes & Hand:

no ceiling & tube below

Ceiling & tube above

Fingers & Wrists:

No ceiling

Ceiling & shoulder access

It is the responsability of the RP officer to ensure that these conditions are met before calculating….

Extrapolations to Annual Doses except eyes

(Eye lens doses: Vanhavere F. et al.)

Annual dose limit for deterministic effects skin :
500 mSv

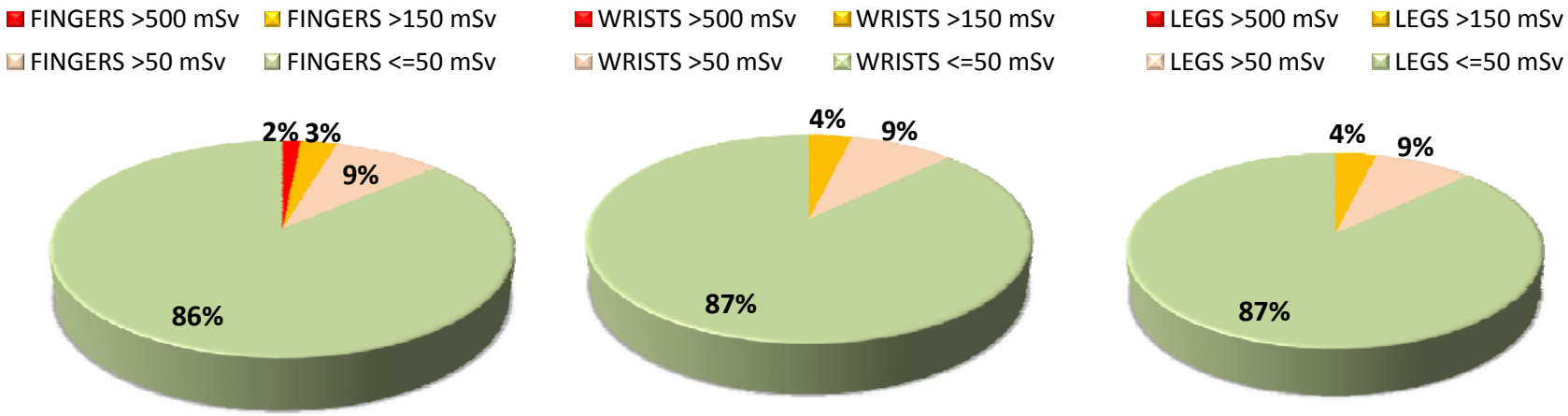
3/10th limit reached or possibly obtained
→ requirement for routine monitoring.

Distribution given in :

> 500 mSv (= limit) ;
> 150 mSv (= high doses; 3/10th of the limit) ;
> 50 mSv (= 1/10th of limit) ;
≤ 50 mSv

Extrapolations to Annual Doses Fingers, Wrists and Legs

Frequency distribution for all procedures

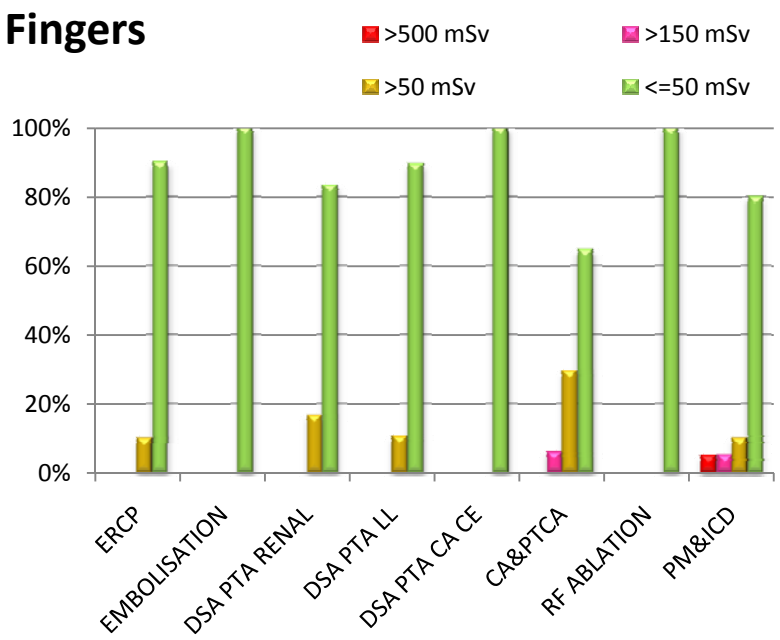


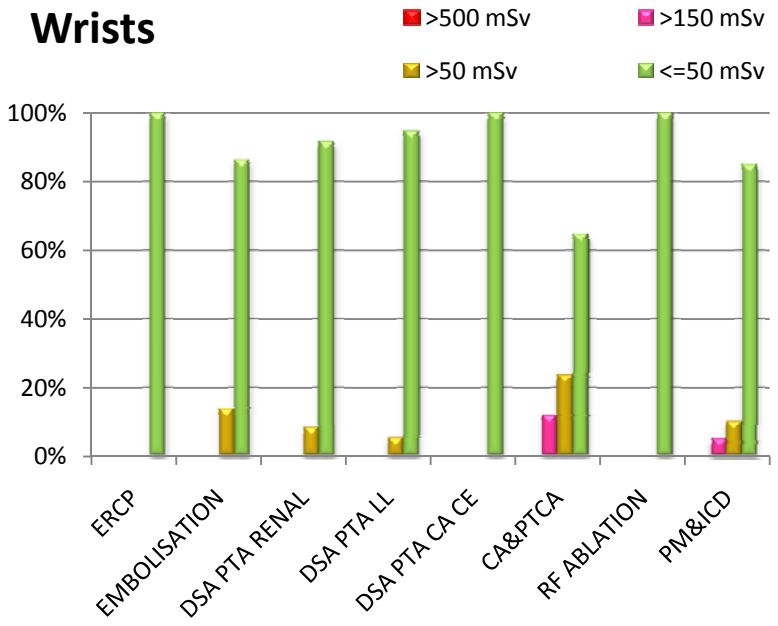
How many times the following values for the annual dose are exceeded

> 500 mSv (= limit) ;
> 150 mSv (= high doses ; 3/10th of limit) ;
> 50 mSv (= 1/10th of limit) ;
≤ 50 mSv

Extrapolations to Annual Doses Fingers, Wrists and Legs

Frequency distribution per procedure





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> 50 mSv (= 1/10 of limit) ;
<= 50 mSv

Extrapolations to Annual Doses Fingers, Wrists and Legs

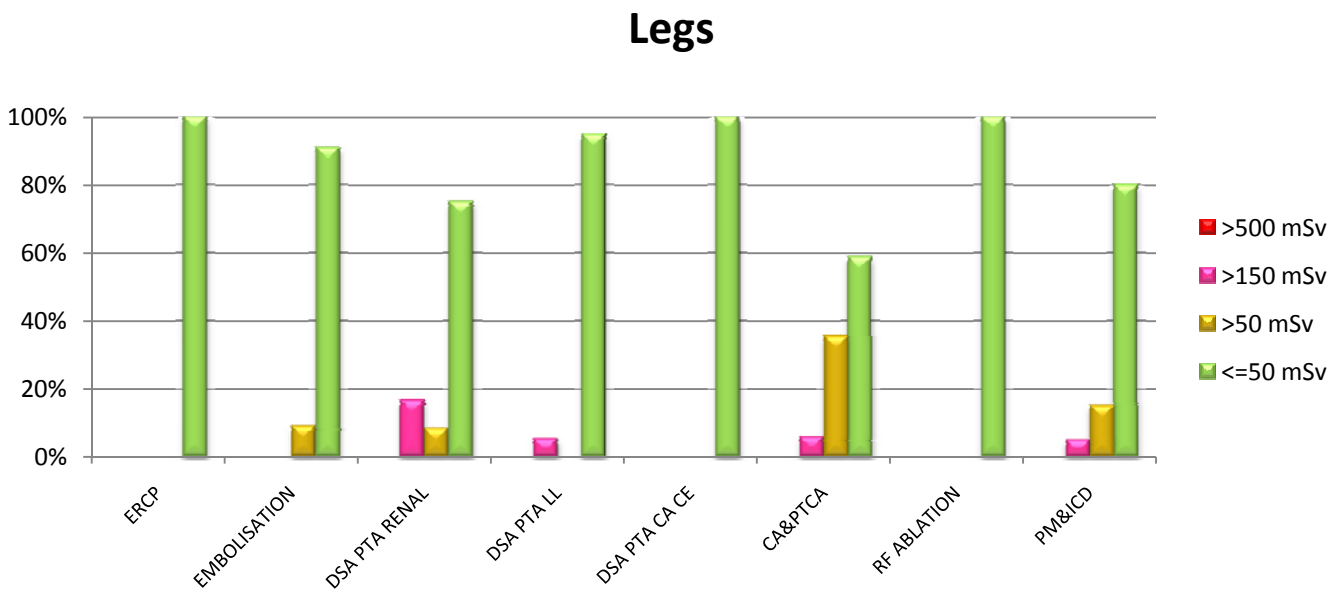
Few workers exceed the annual limit for the fingers !

But possible underestimation

- Estimation of the annual doses based on the procedures for which the operator was monitored
- All procedures should be taken into account for operators performing different types of procedures

Extrapolations to Annual Doses Fingers, Wrists and Legs

Frequency distribution per procedure



How many times the following values for the annual dose are exceeded

> 500 mSv (= limit) ;
> 150 mSv (= high doses ; 3/10th of limit) ;
> 50 mSv (= 1/10th of limit) ;
≤ 50 mSv

Extrapolations to Annual Doses Fingers, Wrists and Legs

Fingers or Wrists : CA&PTCA (5% workers exceed 150mSv/y)

Monitoring of the hands is recommended
Especially for Interventional cardiology

Legs: PM (5% workers exceed 3/10th limit)
DSA PTA renal (almost 20% workers exceed 3/10th limit)

No need of monitoring if table shield properly used


obrigado
Dank U
Merci
mahalo
Köszi
Grazie
Thank you
mauruuru
Takk
Gracias
Dziękuję
Děkuju
danke
Kiitos