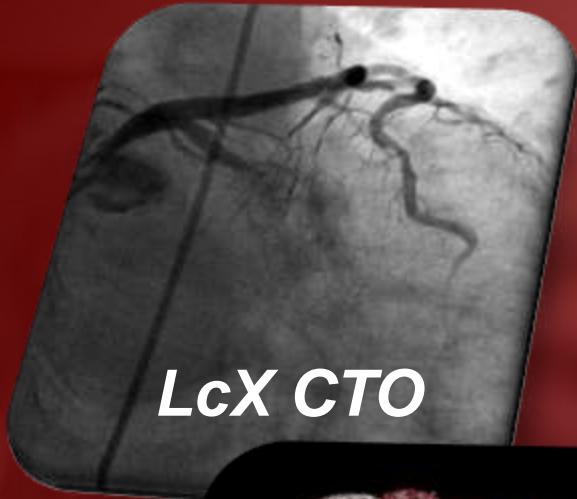




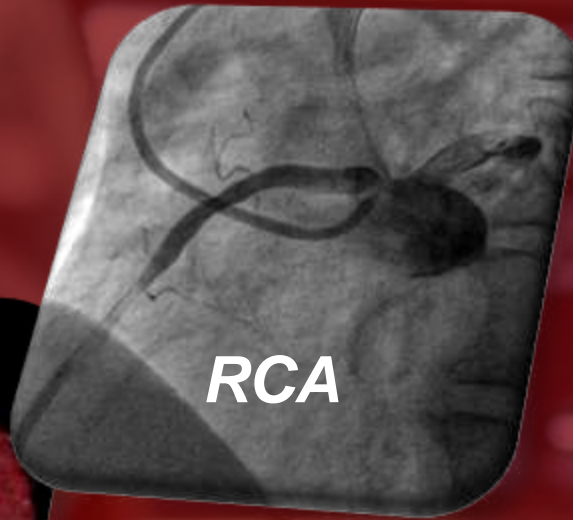
The Management of Radiation Dose in Cath Lab

Joon Won Kang, RT
Cardiovascular Center, Anam Hospital
Korea University Medical Center

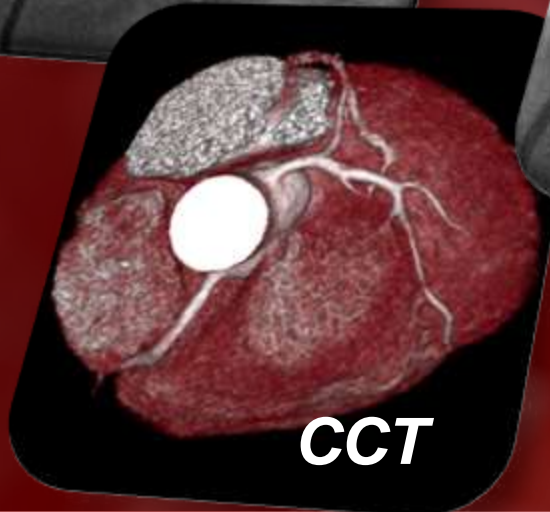
What You Should Know to Tell Your Patient



LcX CTO



RCA



CCT



**Total DAP
(mGycm²)**

**Air Kerma
(mGy)**

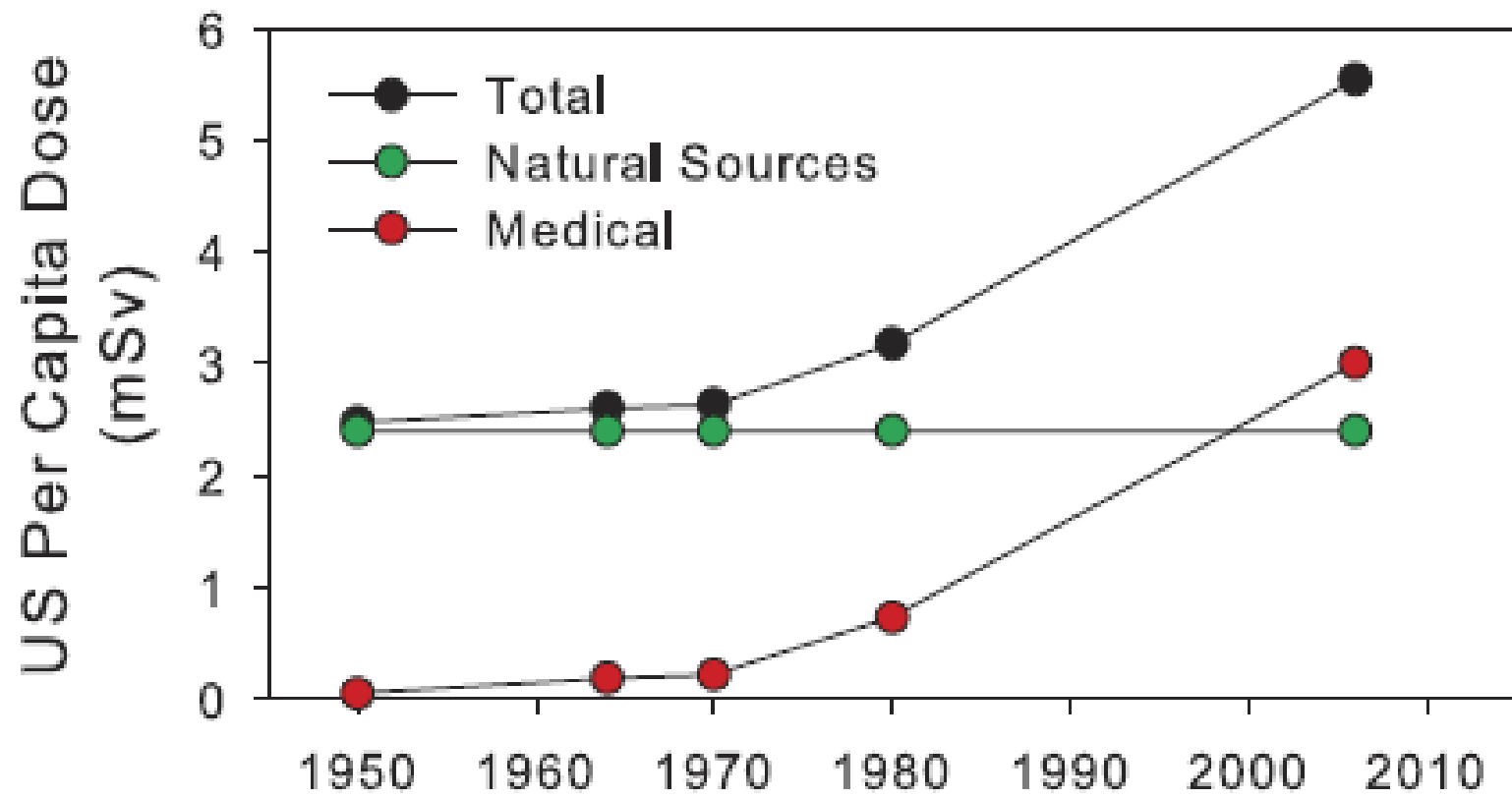
237658

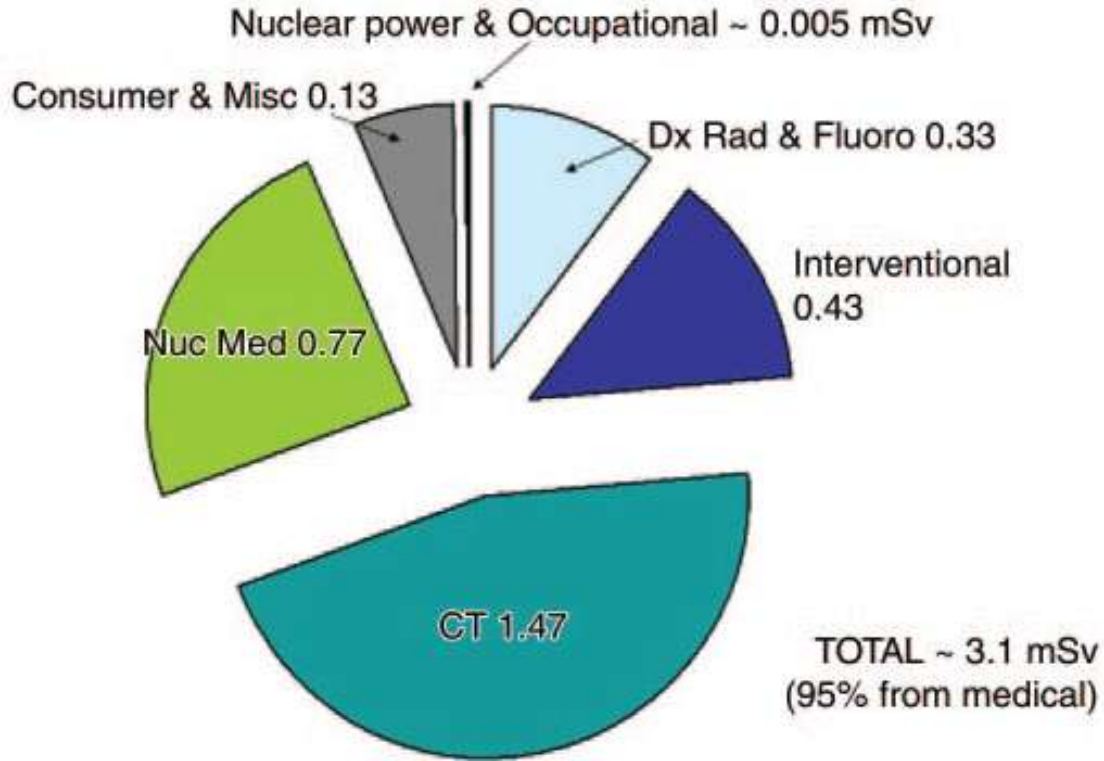
3229.60

**Do You Know Your Radiation Dose
During Your Cath?**

**How do we assess patient radiation
dose?**

**How do we assess radiation doses to
the operators?**





CT



Fluoroscopy



Radiolysis (Indirect Effect)



OH* (Hydroxyl radical)
: the most damaging
($\frac{2}{3}$ of all effects)





Ionizing Radiation



Free Radicals



DNA Damage



Cancer

방사선량 측정방법

입사표면선량 (ESD:Entrance surface dose)

조직의 흡수선량

Time (투시시간측정)

AK: Air Kerma(참고점에서의 공기커마)

DAP: Dose area product 선량-면적곱

AK (Air-Kinetic Energy Released per unit Material)

1cm² area at a **reference point**.

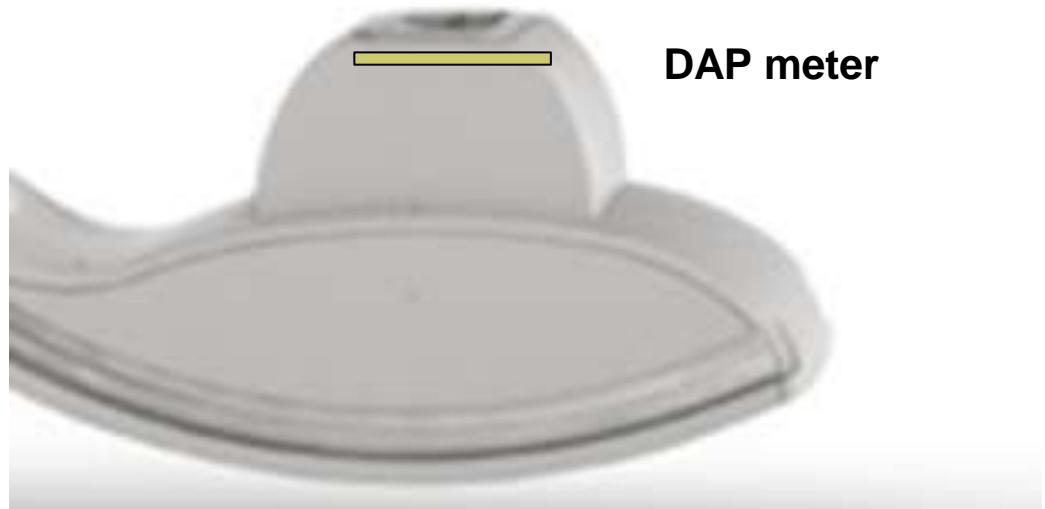
환자의 추정된 입사표면선량

Reference point

● IEC reference point



102	10.7
kV	mA
LAO	1°
CRAN	1°
Height	+12
cm	
SID	100
cm	
FD	10.0
inch	
AK	36.010
	mSv/min



How do we reduce it..???



+25cm



+25cm



1.5
mGy/s



3.0
mGy/s



6.0
mGy/s

102	10.7
kV	mA
LAO	1°
CRAN	1°
Height	+12
cm	
SID	100
cm	
FD	10.0
inch	
AK	36.010
	mGy/s

100	18.7
kV	mA
LAO	1°
CRAN	1°
Height	+12
cm	
SID	120
cm	
FD	10.0
inch	
AK	59.171
	mGy/min

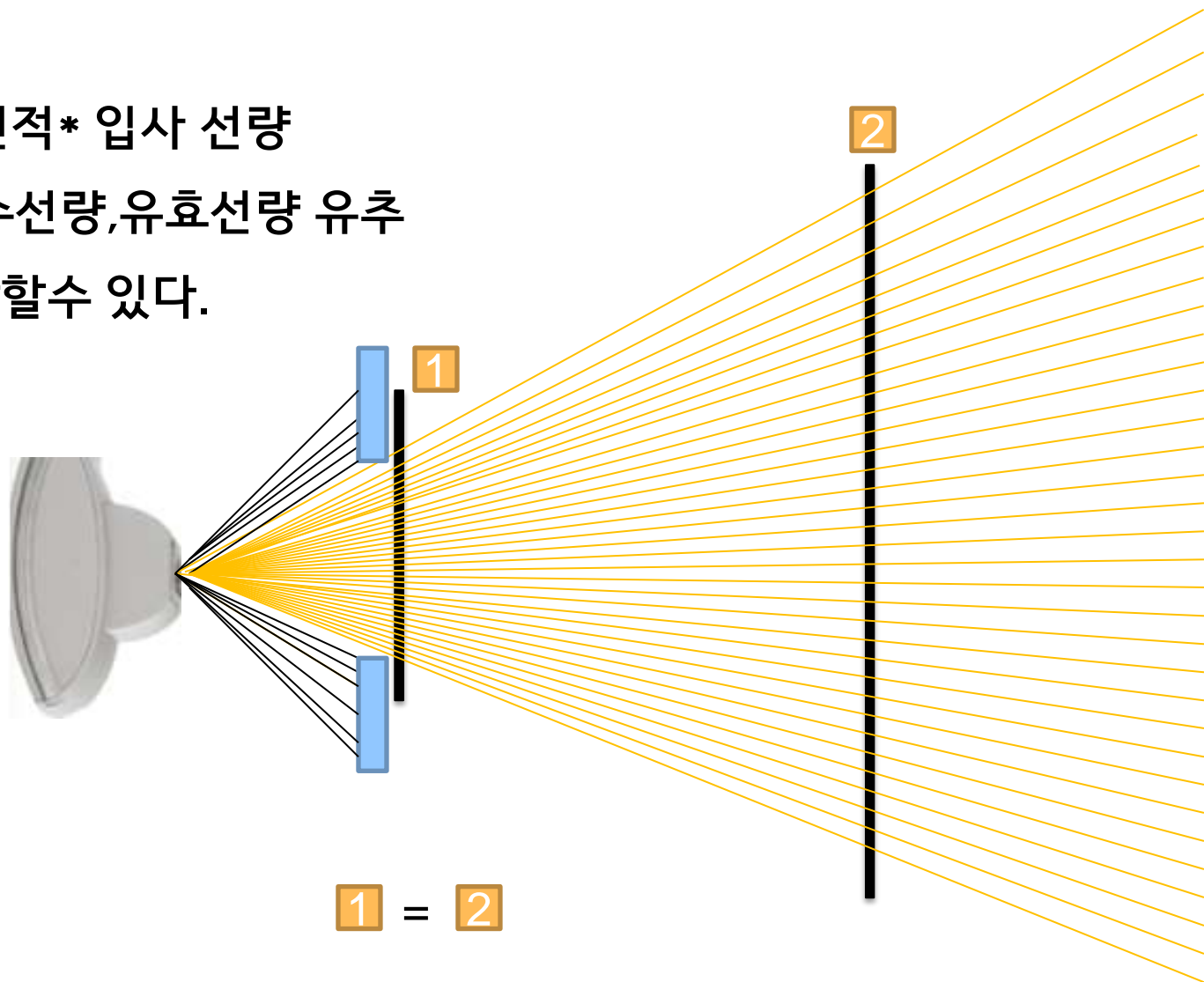
KEEP the SID Down!
Increasing the SID by 20 CM
resulted in a 64% increase in AK!



DAP (Dose Area Product)

조사야의 면적* 입사 선량

1. 계산을 통해 흡수선량, 유효선량 유추
2. 입사선량을 계산할 수 있다.



How can it be used to estimate effective dose?

National Radiological Protection Board

<i>Cardiac procedures</i>		
Diagnostic coronary angiography		0.12
Interventional procedures	Angioplasty	0.20-0.26
	Percutaneous transluminal coronary angioplasty	0.18-0.28

Table 15 Effect of ICRP 60 and ICRP 103 weighting factors in conversion factor ($\text{mSv.Gy}^{-1} \text{cm}^{-2}$) value.

	Cardiac procedures		
	female	male	mean
ICRP 60	0.20	0.19	0.19
ICRP 103	0.25	0.21	0.23





Dose information



의료정보
시스템
(HIS)



환자
선량관리
프로그램

DR



Dicom header
PACS

CT



DLP
Database

Angio



DAP
MPPS- PACS
Manual (Report)

-
-
-

**Conversion
factor**

NRPB, ICRP60,102

**Effective
Dose**



NRPB : National Radiological Protection Board (국립방사선보호위원회)
ICRP : International Commission on Radiological Protection (국제방사선방어위원회)

0 [강] M/55세 건강보험 ? 소화기내과 엄순호/정한샘 MIC-12 진단 Liver cell carcinoma

UTPS E6DT 02-14 [금] 오후 05:17 EMR(A) [HD] 5 [POD] [신장] 160.5 [체중] 51.2

기본 투약 검사 수혈 처치 자료 [진단예약] [체중별용량] 체중 [계산식] 검사결과 Font

SET 전처방 검사 투석 처방일 2014-02-15 처방종류 일반 발행처 내과ICU 처방형태 정규 항암제 보유약 항생제

Abdomen (CT) [B] ICU 외래요약 내역 [입력모드]

LIVER DYNAMIC CT [CE] [2중, 3중]

- 환자검사 LIVER DYNAMIC CT
- LIVER CT OF DURING
- BILIARY & PANCREAS
- GU, GV CT(A+P)[CE]
- GU, GV CT(A+P) [NO
- TRAUMA ABDOMEN CT
- PELVIS CT (NON CE)
- TRAUMA ABDOMEN CT
- CT COLONOGRAPHY (F
- CT COLONOGRAPHY (F
- CT COLONOGRAPHY (F

검사일자 2013-02-21 ~ 2014-02-21 환자번호 [] 조회

조회기간 유효선량계 148.6986 mSv

실시일자	검사코드	검사명	나이	체중	신장	BMI	유효선량
2014-02-17	GPGCHPAL	CHEST PA & LT LAT	79				.09
2014-02-06	GPGCHPAL	CHEST PA & LT LAT	79	73.7	160.1	28.8	.09
2014-02-04	GPATUPCN	TUBOGRAM PCN [UNILATERAL]	79	73.7	160.1	28.8	.774
2014-02-03	GPADOJR	DOUBLE J INSERTION	79	73.7	160.1	28.8	4.815
2014-02-03	GPATUPCN		79	73.7	160.1	28.8	.81
2014-02-03			79	73.7	160.1	28.8	.09
2014-01-31			79	73.7	160.1	28.8	.09
2014-01-31			79	73.7	160.1	28.8	.2
2014-01-27			79	73.7	160.1	28.8	.09
2014-01-23			79	73.7	160.1	28.8	1.503
2014-01-23			79	73.7	160.1	28.8	.09
2014-01-23			79	73.7	160.1	28.8	1.5
2014-01-21			79	73.7	160.1	28.8	1.26
2014-01-20			79	73.7	160.1	28.8	32.385
2014-01-15			79	73.7	160.1	28.8	0

2014-01-01 00:00:00
 홍길동
 2014년01월01일
 01234689
 F/100세 (12mSV)

년도	1월	10월	11월	12월	총량
2014	142.0296	0	0	0	148.6986

환자의 의료상 방사선 피폭에서는 선량 한도를 적용하지 않으나, 연간 100mSv를 초과할 경우 인체의 세포내에 비정상적인 변화가 발생할 가능성이 있습니다. (ICRP/국제방사선방호위원회)

방사선 피폭량을 환자에게 고지토록 의무화한 법안

- 국회의안 정보시스템

의료법 일부개정법률안

▶ 심사진행단계

접수 → 위원회
심사 → 체계지구
심사 → 본회의
심의 → 정부
이송 → 공포

▶ 의안접수정보

의안번호	제안일자	제안자	문서	제안이유 및 주요내용	제안회기
1909171	2014-01-28	이상민의원 등 10인 ▶ 목록	의안원문		제 19대 (2012~2016) 제 321 회

▶ 소관위 심사정보

소관위원회	회부일	상정일	처리일	처리결과	문서
보건복지위원회	2014-01-29				

부가정보

진단의 효율성 ↓, 오진, 공포심만 조성?



최적화된 의료방사선의 정당화 추구



환자에게 양질의 의료서비스 제공



안전한 병원 이미지



OCS를 통한 의료진에게 선량제공 및
향후 선량자동화 프로그램과의 연동 계획

12 Pearls

Radiation protection of *Patients & Staff* in fluoroscopy

Time

Distance
(Tube-Patient-Detector)

Shield
(TLD)

**Pulsed
Fluoroscopy**
(Frame rate)

SID
(Detector)

**Tube
Angle**

Magnification

**Quality
Control**

**Hands
outside**

**Last
Image
Hold**

Collimation
(Hand outside)

Knowledge

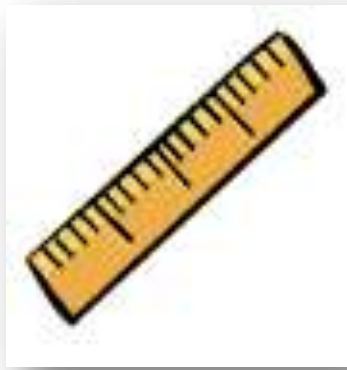
TIME



Minimize time

DAP/AK

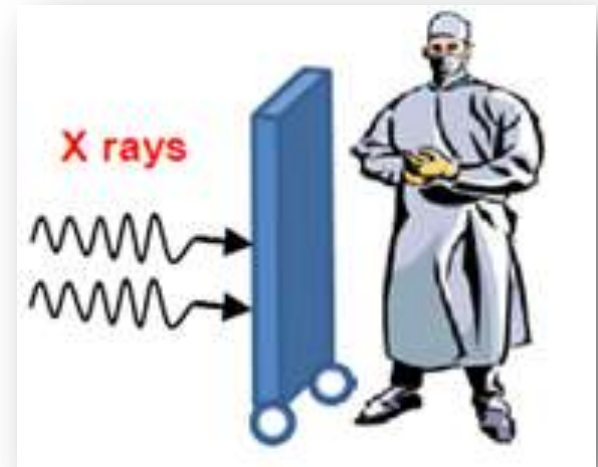
Distance



Patient - Table

Staff - Maximize

Shield



0.5 mm

(>90% protection)

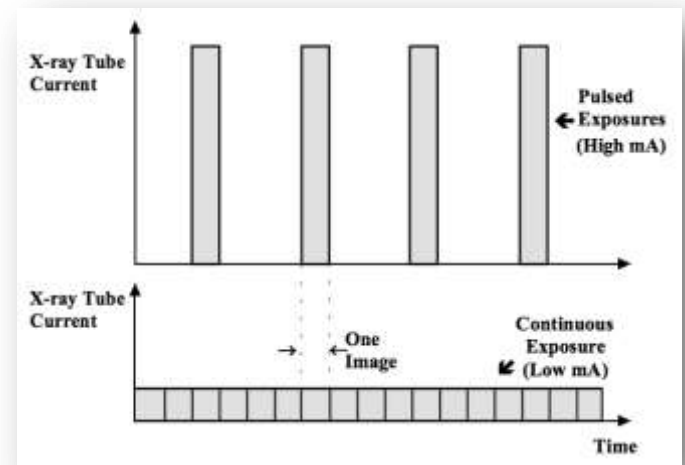
Low dose option Frame rate

Fluoroscopy Setting



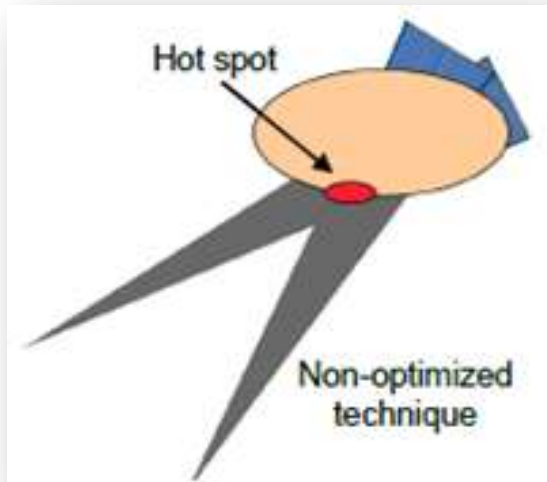
High kV – Skin ↓
– Scattered ↑

Pulsed Fluoroscopy



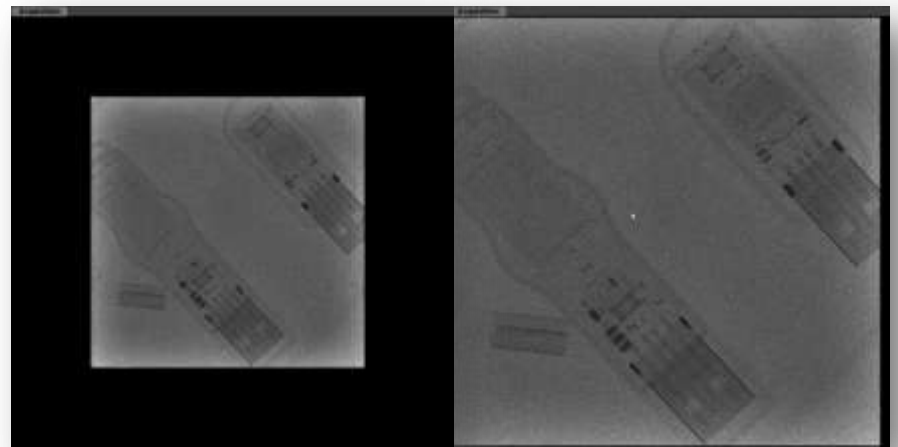
**Alternating switch on
and off during pedaling**

Tube Angle



Avoid exposing the same area

Magnification



Increase X-ray intensity to maintain the brightness of display

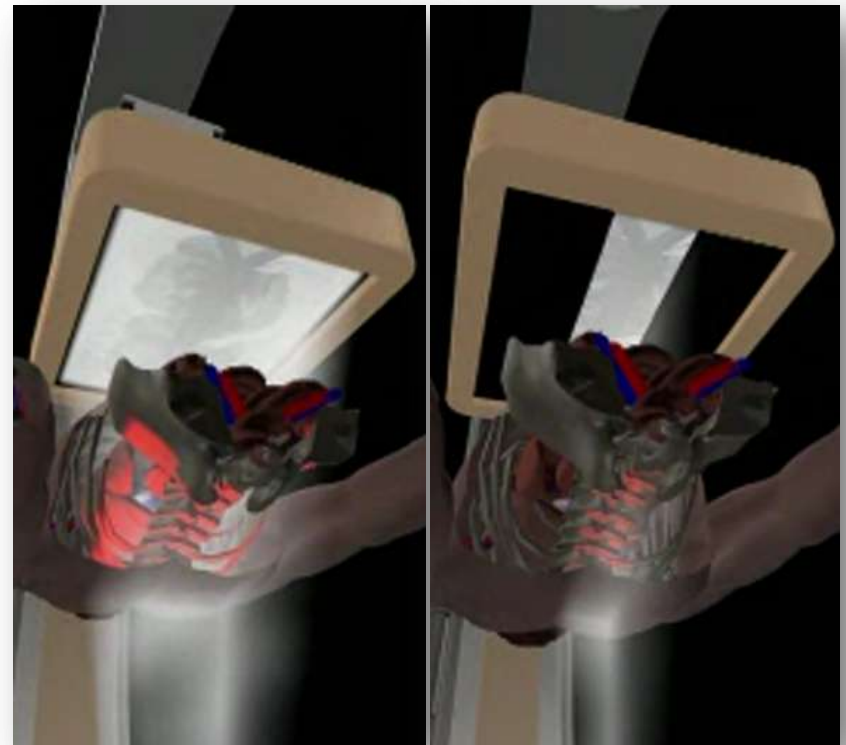
Last Image Hold



High level of image resolution is not required

“SAVE”

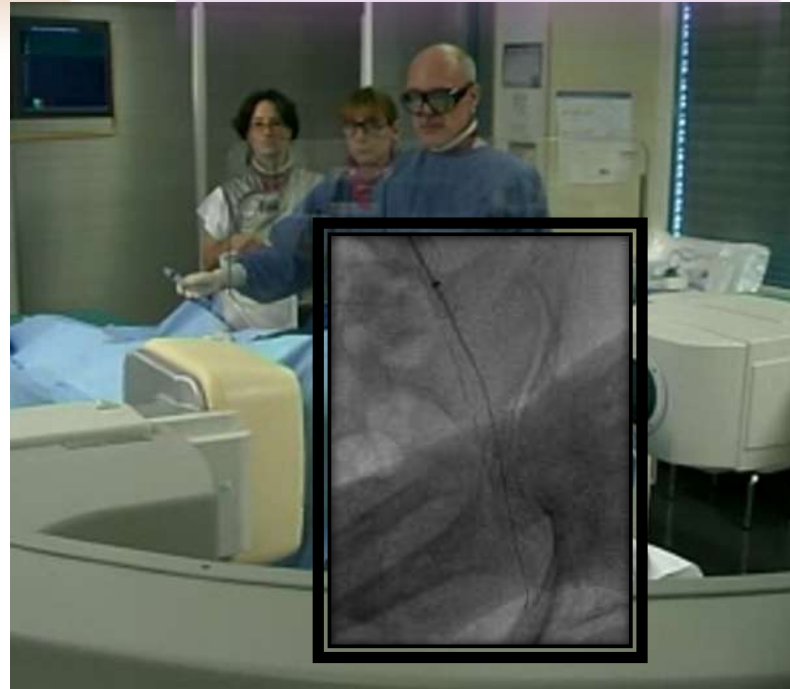
Collimation (Hand outside)



Tube Angle



Keep hands outside



Only **1-5%** of the incident radiation and its respective scatter

Shield

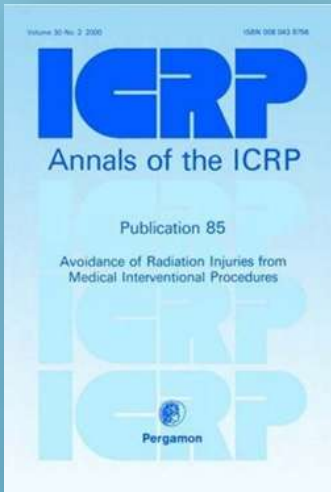


TLD



Controlling dose to staff

Wear protective apron & glasses, use shielding
Correct positioning to machine to minimise dose



Remember

Controlling dose to patient will
help control dose to staff

Thank you for your attention!

