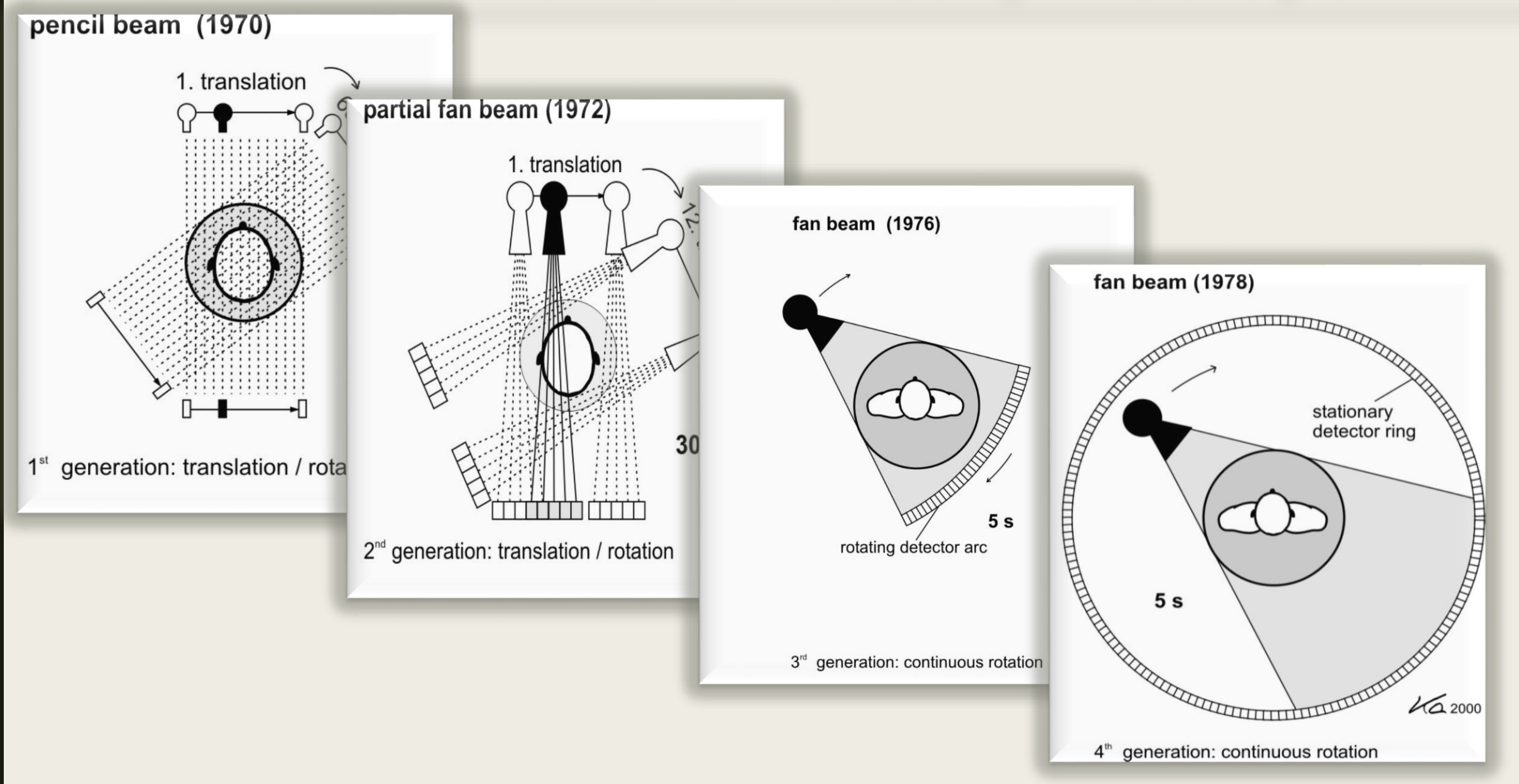
17. Ulusal Medikal Fizik Kongresi - 2019, İstanbul

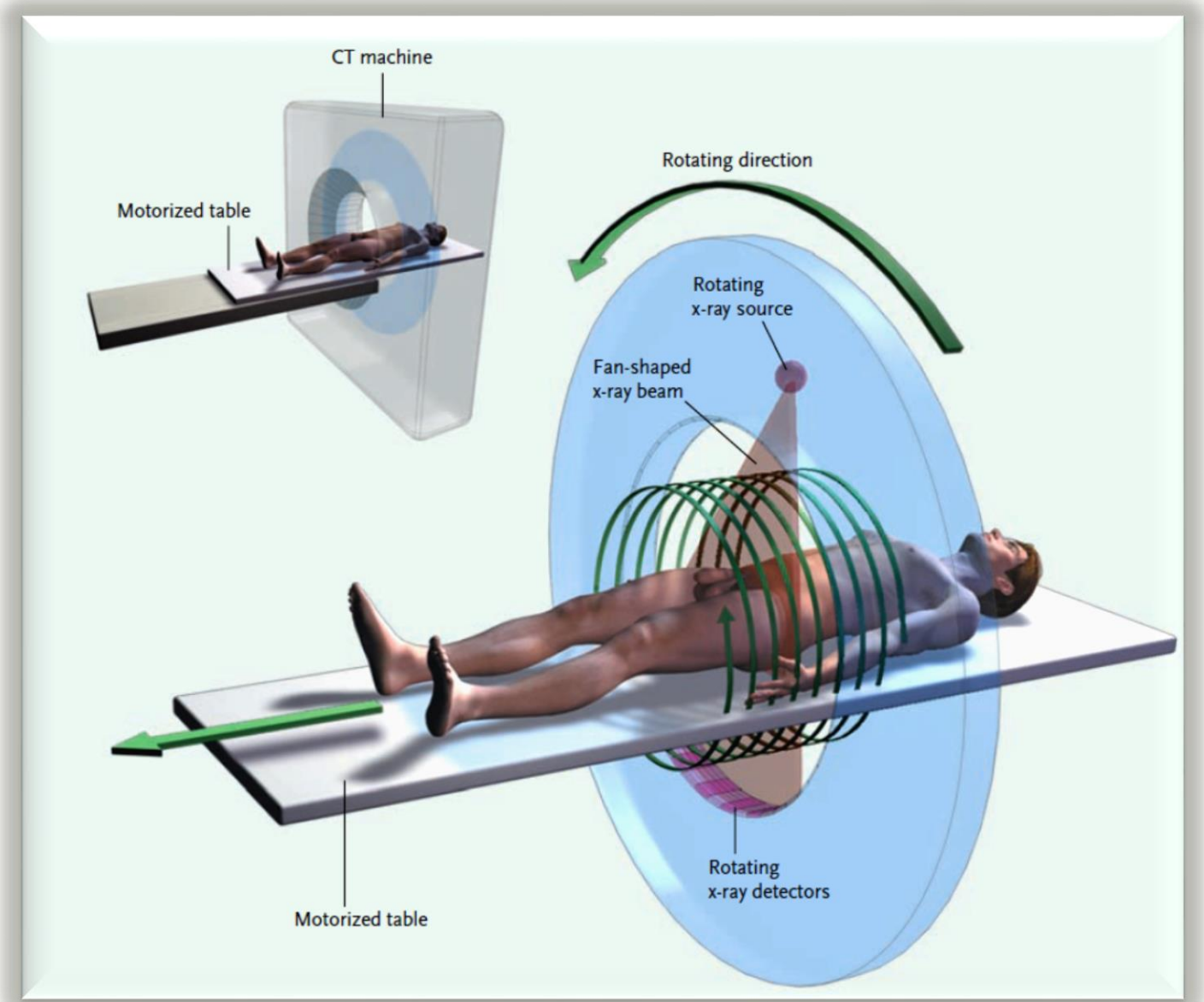
BİLGİSAYARLI TOMOGRAFİDE DOZ VE AZALTIM YÖNTEMLERİ

İSMAİL ÖZSOYKAL
DOKUZ EYLÜL ÜNİVERSİTESİ
MEDİKAL FİZİK ANABİLİM DALI

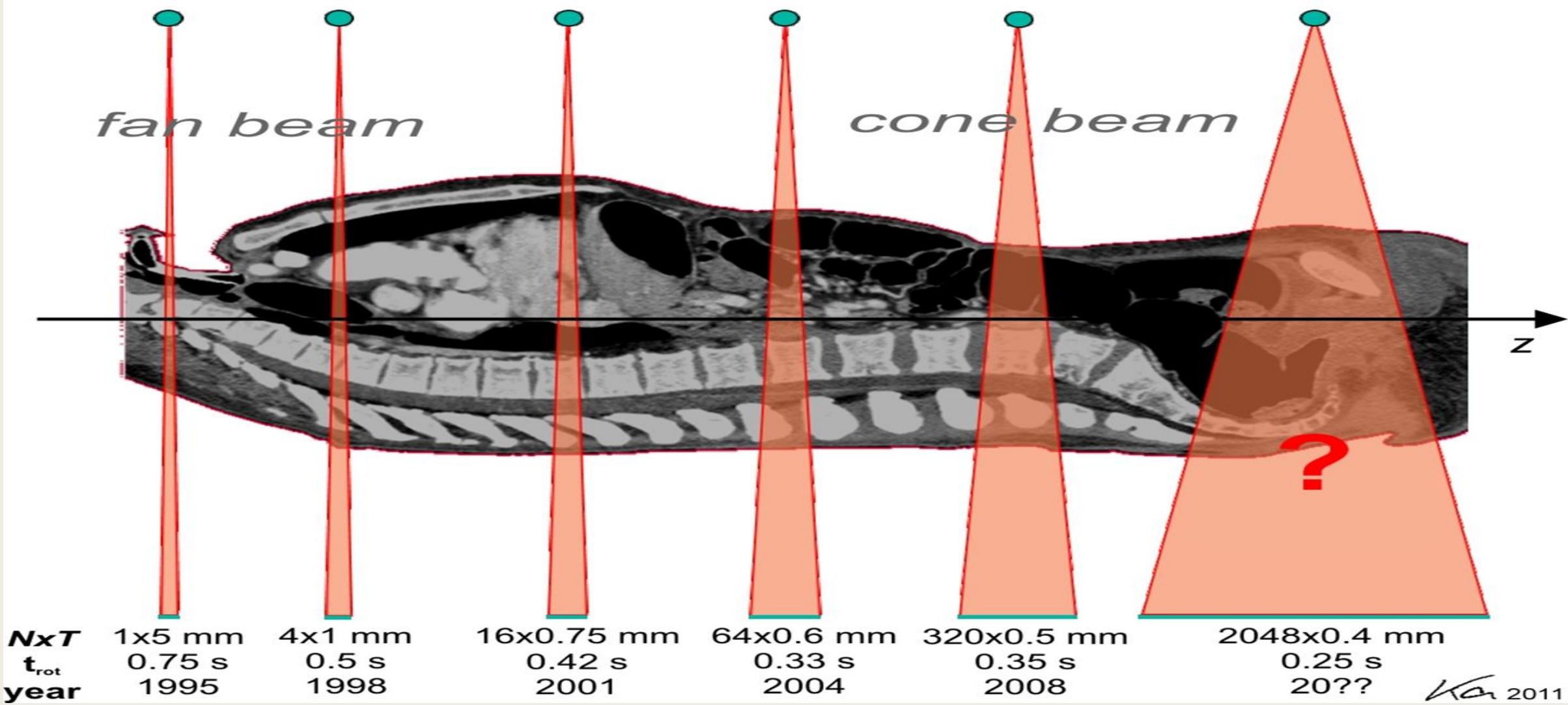
BT Sistemlerinde Hedef ve Gelişim Süreçleri



BT Sistemlerinde Hedef ve Gelişim Süreçleri



BT Sistemlerinde Hedef ve Gelişim Süreçleri



Spiral BT vs Aksiyel BT

Spiral BT vs Aksiyel BT

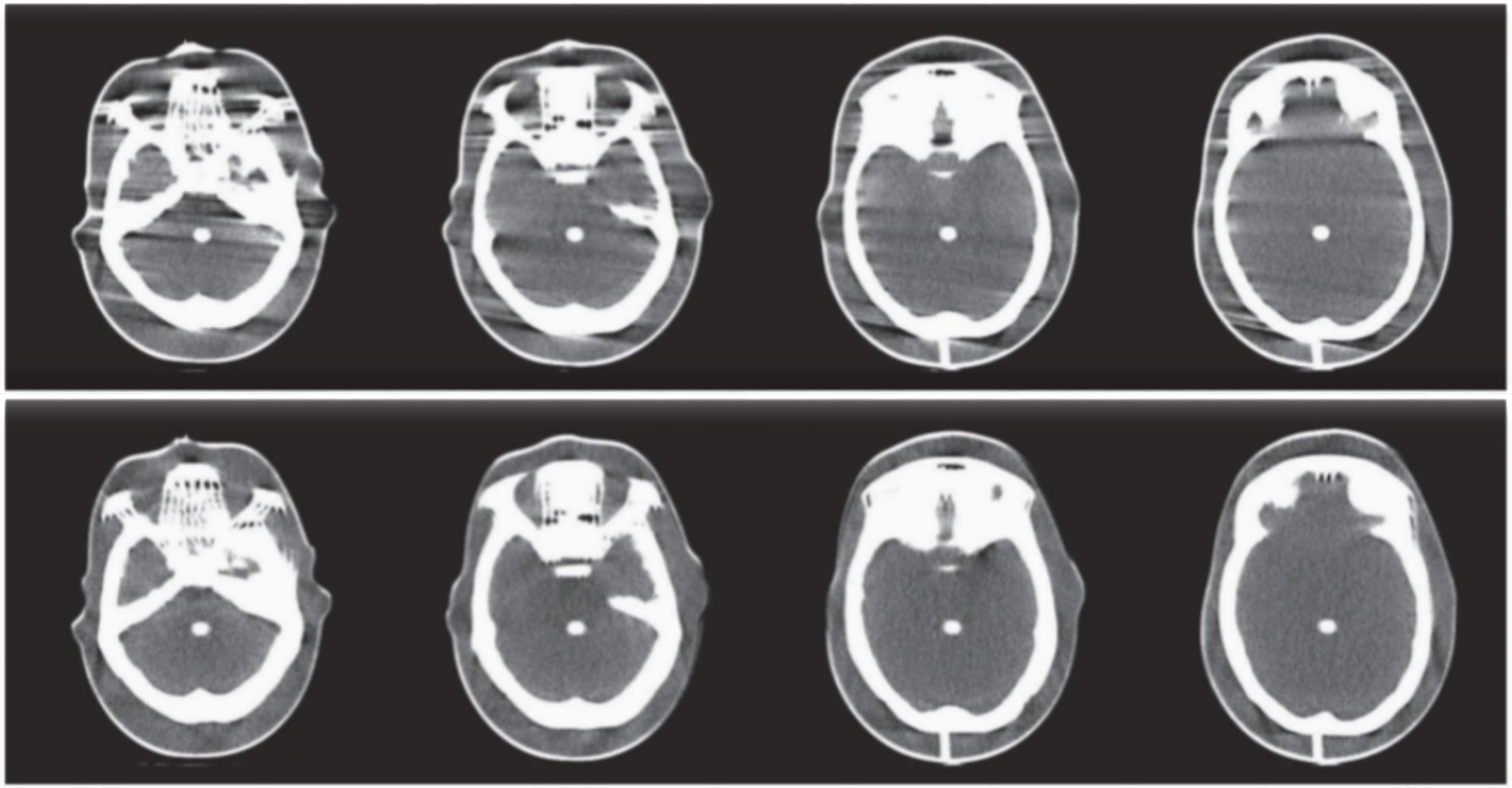
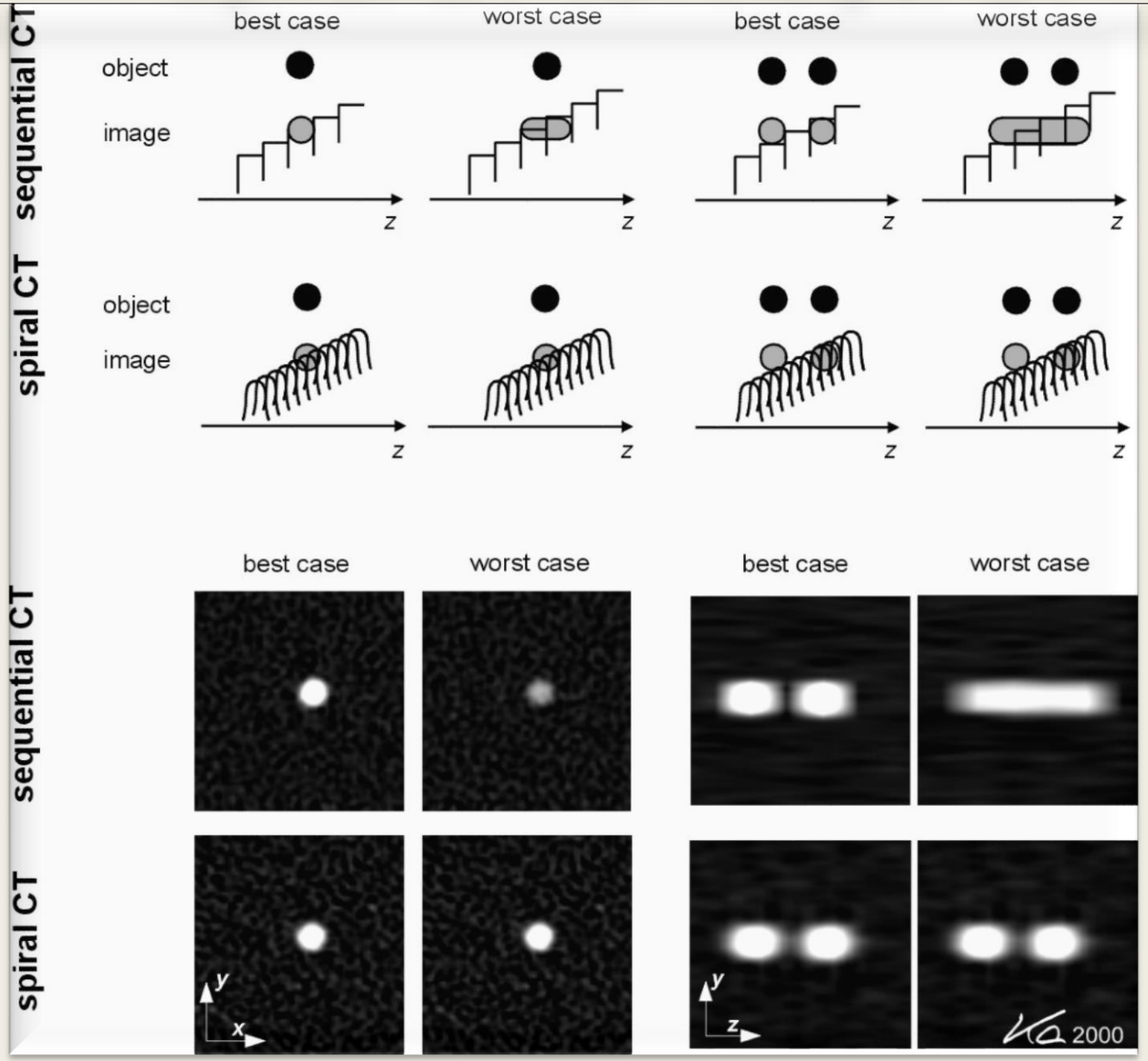


Fig. 8 Images of moving skull phantom for (a) non-helical (non-stacked) and (b) helical (64×0.5 mm, PF: low).

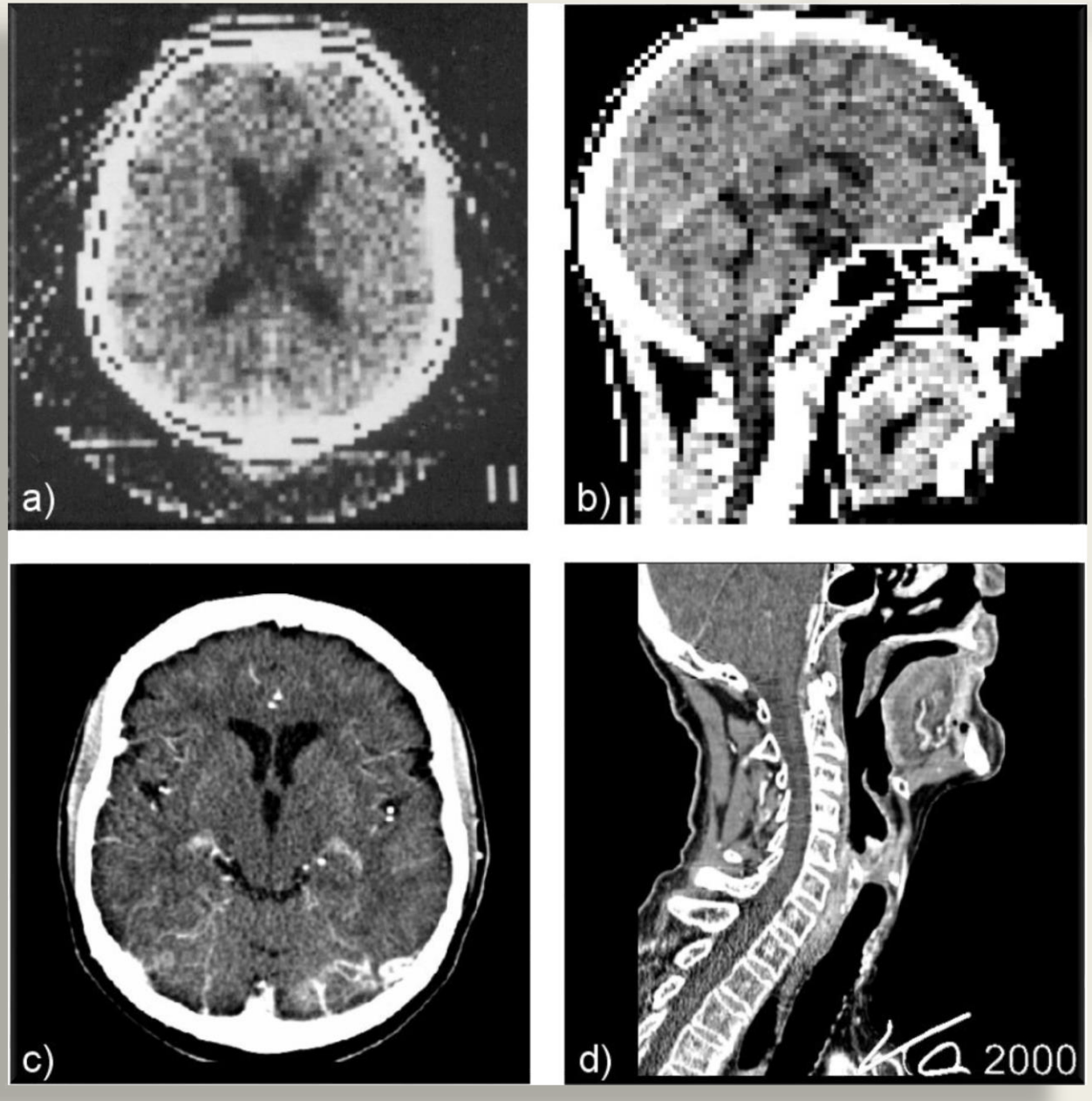
a

b

Spiral BT vs Aksiyel BT

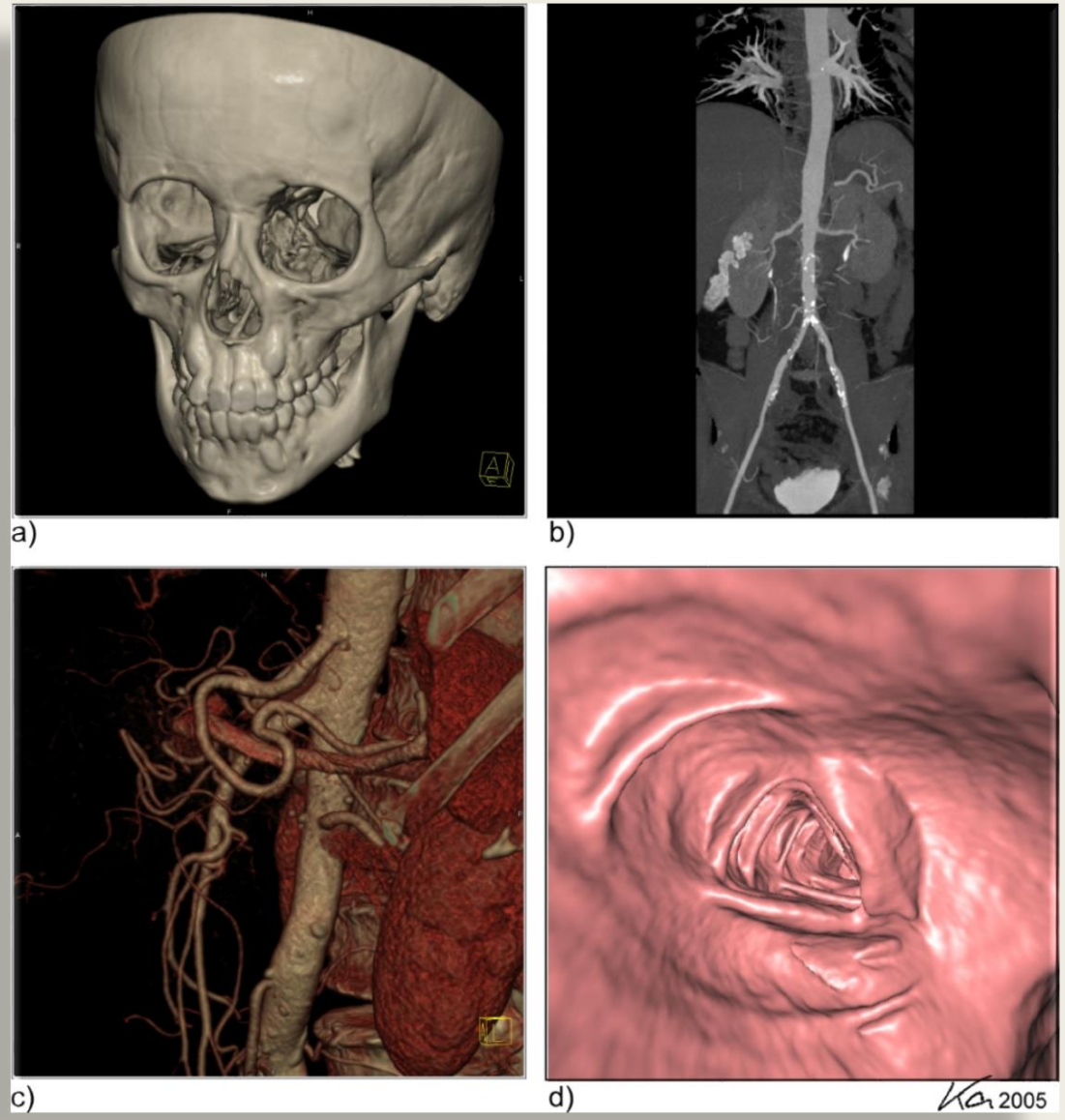


Spiral BT vs Aksiyel BT

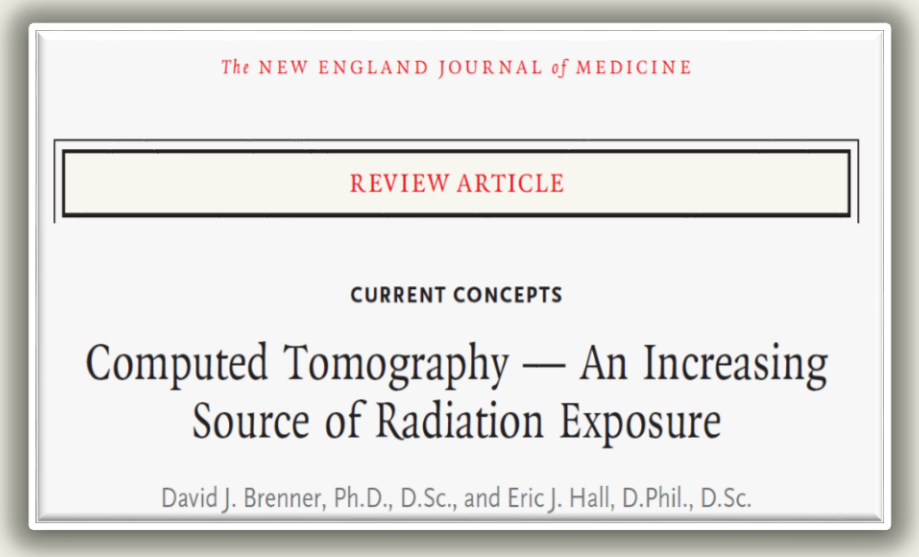


Klinikte Artan BT Kullanımı

- Kardiyovasküler incelemeler
- Kontrastlı incelemeler
- Acil travma incelemeleri
- Pediatrik incelemeler (!!)
- Yetişkinlerde tüm vücut incelemeler



Klinikte Artan BT Kullanımı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REVIEW ARTICLE

CURRENT CONCEPTS

Computed Tomography — An Increasing Source of Radiation Exposure

David J. Brenner, Ph.D., D.Sc., and Eric J. Hall, D.Phil., D.Sc.

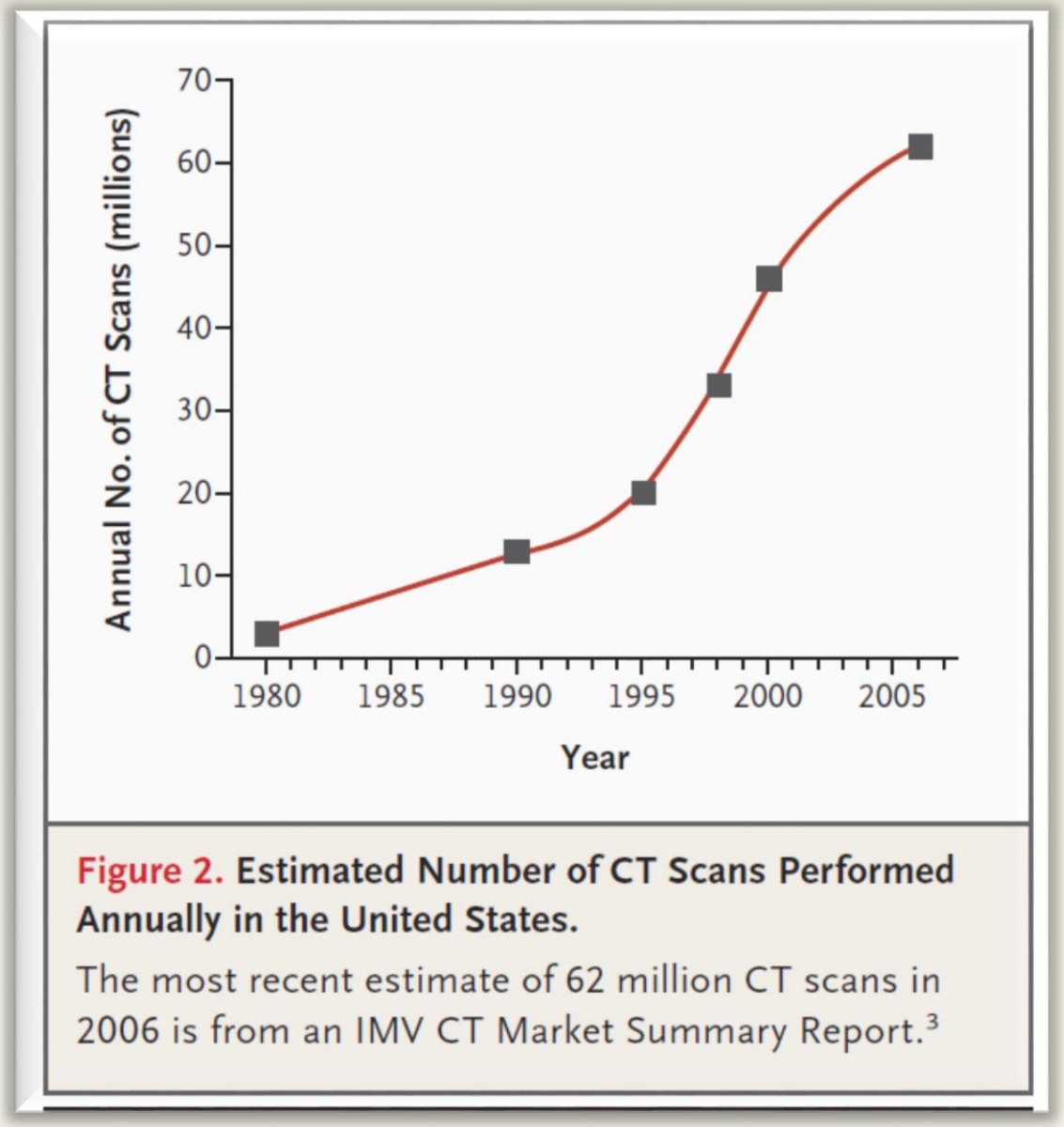


Figure 2. Estimated Number of CT Scans Performed Annually in the United States.

The most recent estimate of 62 million CT scans in 2006 is from an IMV CT Market Summary Report.[3]

Klinikte Artan BT Kullanımı

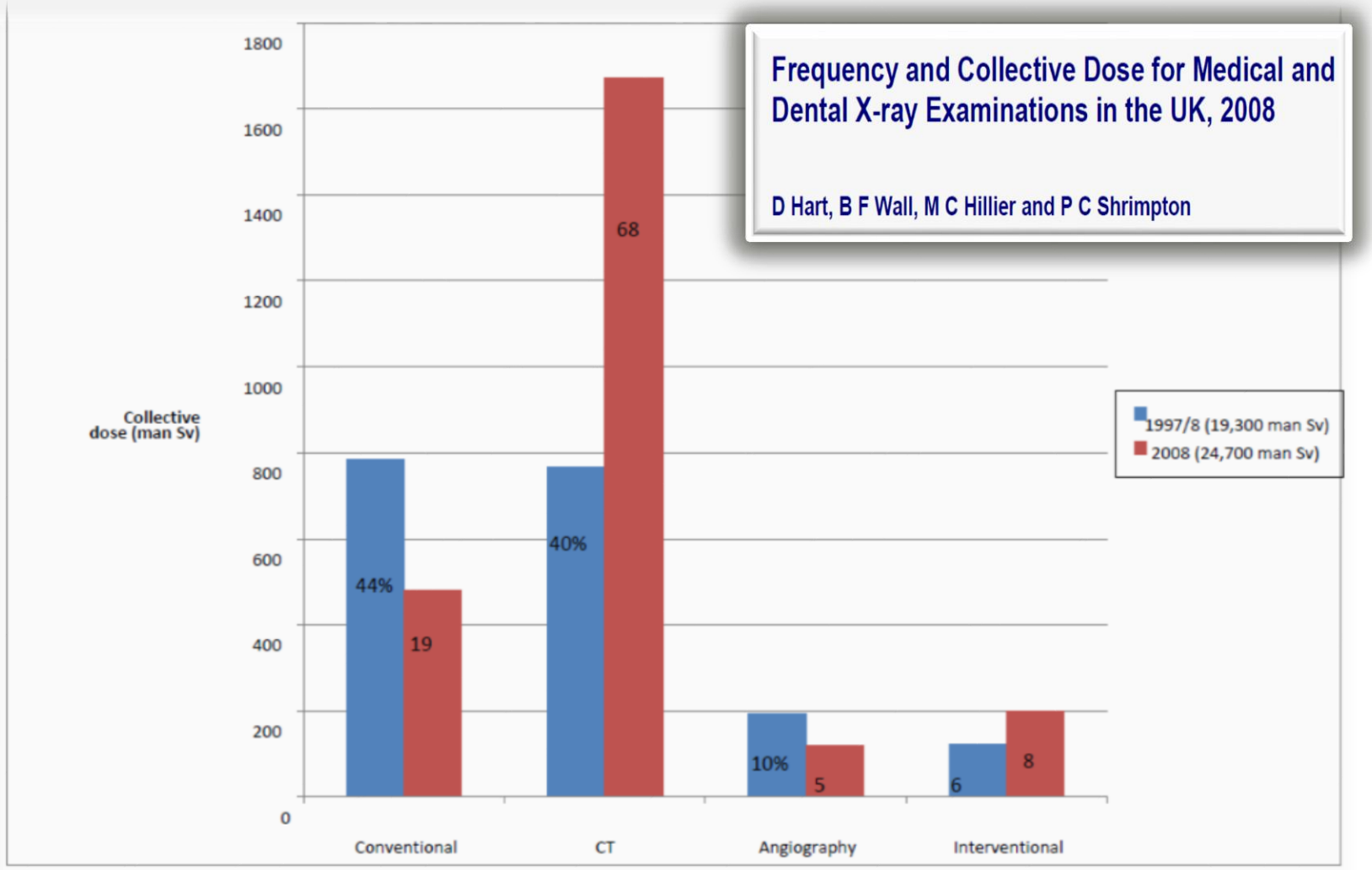
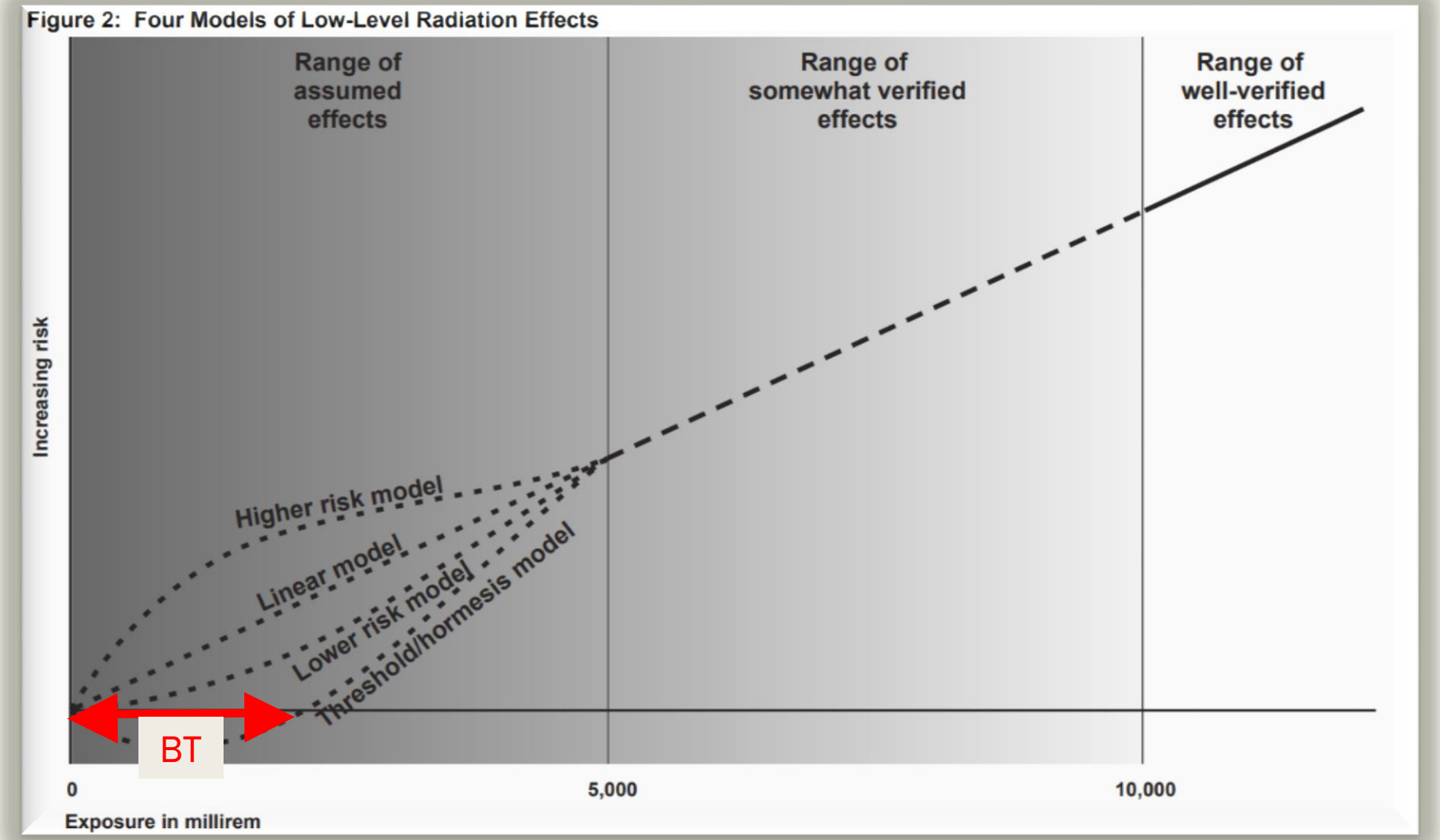


FIGURE 3 Comparison by broad type of contributions to UK collective dose from medical and dental X-ray examinations

BT Taramasından Kaynaklanan Riskler (?)



RCED-00-152 Radiation Standards: Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues

BT Taramasından Kaynaklanan Riskler (?)

Estimated Risks of Radiation-Induced Fatal Cancer from Pediatric CT

David J. Brenner[1]
Carl D. Elliston[1]
Eric J. Hall[1]
Walter E. Berdon[2]

OBJECTIVE. In light of the rapidly increasing frequency of pediatric CT examinations, the purpose of our study was to assess the lifetime cancer mortality risks attributable to radiation from pediatric CT.

MATERIALS AND METHODS. Organ doses as a function of age-at-diagnosis were estimated for common CT examinations, and estimated attributable lifetime cancer mortality risks

Risk of cancer after low doses of ionising radiation: retrospective cohort study in 15 countries

E Cardis, M Vrijheid, M Blettner, E Gilbert, M Hakama, C Hill, G Howe, J Kaldor, C R Muirhead, M Schubauer-Berigan, T Yoshimura, F Bermann, G Cowper, J Fix, C Hacker, B Heinmiller, M Marshall, I Thierry-Chef, D Utterback, Y-O Ahn, E Amoros, P Ashmore, A Auvinen, J-M Bae, J Bernar Solano, A Biau, E Combalot, P Deboodt, A Diez Sacristan, M Eklof, H Engels, G Engholm, G Gulis, R Habib, K Holan, H Hyvonen, A Kerekes, J Kurtinaitis, H Malker, M Martuzzi, A Mastauskas, A Monnet, M Moser, M S Pearce, D B Richardson, F Rodriguez-Artalejo, A Rogel, H Tardy, M Telle-Lamberton, I Turai, M Usel, K Veress

BT Taramasından Kaynaklanan Riskler (?)

Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries

Amy Berrington de González, Sarah Darby

Summary

Background Diagnostic X-rays are the largest man-made source of radiation exposure to the general population, contributing about 14% of the total annual exposure

Introduction

Diagnostic X-rays are the largest man-made source of radiation exposure to the general population, contributing about 14% of total worldwide exposure from man-made and natural sources.[1] However,

Estimation of Cancer Mortality Associated with Repetitive Computed Tomography Scanning

Pim A. de Jong, John R. Mayo, Kamran Golmohammadi, Yasutaka Nakano, Maarten H. Lequin, Harm A. W. M. Tiddens, John Aldrich, Harvey O. Coxson, and Don D. Sin

Departments of Pediatric Pulmonology and Allergology and Pediatric Radiology, Erasmus MC–Sophia Rotterdam, Rotterdam, The Netherlands; James Hogg iCAPTURE Centre for Cardiovascular and Pulmonary Research, St. Paul's Hospital; Pulmonary Division, Department of Medicine, University of British Columbia; Subdivision of Radiation Physics, Department of Radiology, Vancouver General Hospital, Vancouver, British Columbia; Department of Radiology and Diagnostic Imaging, University of Alberta, Edmonton, Alberta, Canada; and Department of Cardiovascular and Respiratory Medicine, Shiga University of Medical Science, Shiga, Japan

BT Taramasından Kaynaklanan Riskler (?)

ICRP 103

from an analysis con[illegible]y the Commission (*Publication 99*, ICRP, 2005d), the [illegible] adoption of the LNT model combined with a judged [illegible]effectiveness factor (DDREF) provides a prudent basis [illegible] purposes of radiological protection, i.e., the management of risks from low-dose radiation exposure.

(66) However, the Commission emphasises that whilst the LNT model remains a scientifically plausible element in its practical system of radiological protection, biological/epidemiological information that would unambiguously verify the hypothesis that underpins the model is unlikely to be forthcoming (see also UNSCEAR, 2000, NCRP 2001). Because of this uncertainty on health effects at low doses, the Commission judges that it is not appropriate, for the purposes of public health planning, to calculate the hypothetical number of cases of cancer or heritable disease that might be associated with very small radiation doses received by large numbers of people over very long periods of time (see also Sections 4.4.7 and 5.8).

(67) In arriving at its practical judgement on the LNT model, the Commission has considered potential challenges associated with information on cellular adaptive responses, the relative abundance of spontaneously arising and low-dose-induced DNA damage and the existence of the post-irradiation cellular phenomena of induced genomic instability and bystander signalling (*Publication 99*, ICRP, 2005d). The

BT Taramasından Kaynaklanan Riskler (?)

ICRP 103

(j) Effective dose is [illegible] for use as a protection quantity. The main uses of [illegible]ve dose assessment for planning and optimisation in [illegible], and demonstration of compliance with dose limits for regulatory purposes. Effective dose is not recommended for epidemiological evaluations, nor should it be used for detailed specific retrospective investigations of individual exposure and risk.

(k) The collective effective dose quantity is an instrument for optimisation, for comparing radiological technologies and protection procedures, predominantly in the context of occupational exposure. Collective effective dose is not intended as a tool for epidemiological risk assessment, and it is inappropriate to use it in risk projections. The aggregation of very low individual doses over extended time periods is inappropriate, and in particular, the calculation of the number of cancer deaths based on collective effective doses from trivial individual doses should be avoided.

(l) In order to assess radiation doses, models are necessary to simulate the geom-

BT Taramasından Kaynaklanan Riskler (?)

Projected Cancer Risks from Computed Tomographic Scans Performed in the United States in 2007

Berrington de Gonzalez A, Mahesh M, Kim K-P, et al. Arch Intern Med 2009;169:2071-7.

estimate the median number of radiation-related incident cancers with 95% uncertainty limits (UL).

The authors estimated approximately 29,000 (95% UL, 15,000-45,000) future cancers will be related to CT scans performed in 2007 in the United States. Scans of the abdomen and pelvis, chest, and head, and chest CT angiography, will be the largest contributors to new cancers (n = 14,000, 95% UL 6900-25,000 for abdomen and pelvis; n = 41,000, 95% UL 1900-8100 from chest scans; n = 4000, 95% UL 1100-8700 for head scans; and n = 2,700, 95% UL 1,300-5,000 for CT angiography). According to the model, 33% of projected cancers will be from scans performed at ages of 35 to 54 years, 15% will be due to scans performed at age <18, and 66% of projected cancers will be in women.

Comment: Assuming, as the authors do, a 50% mortality rate from the CT-induced cancers, the study suggests about 15,000 people will die as a direct result of CT scans performed in 2007 alone. This article and that by Smith-Berdman et al, also featured in this Abstract Section of the JVS,

BT Taramasından Kaynaklanan Riskler (?)

CHICAGO (Reuters) - Radiation from CT scans done in 2007 will cause 29,000 cancers and kill nearly 15,000 Americans, researchers said on Monday CHICAGO Mon Dec 14, 2009 4:30pm EST

About 70 million CT scans were done on Americans in 2007, up from 3 million in 1980. Amy Berrington de Gonzalez of the National Cancer Institute and colleagues developed a computer model to estimate the impact of so many scans.

They estimated the scans done in 2007 will cause 29,000 cancers. A third of the projected cancers will occur in people who were ages 35 to 54 when they got their CT, two-thirds will occur in women and 15 percent will arise from scans done in children or teens.

The researchers estimated there will be an extra 2,000 excess breast cancers just from CT scans done in 2007.

Yaşam Boyu Kansere Yakalanma/Ölüm Riski

American Cancer Society®

Cancer Facts & Figures

2019

Table 6. Probability (%) of Developing Invasive Cancer during Selected Age Intervals by Sex, US, 2013-2015*

		Birth to 49	50 to 59	60 to 69	70 and older	Birth to death
All sites†	Male	3.4 (1 in 30)	6.1 (1 in 16)	13.2 (1 in 8)	31.9 (1 in 3)	39.3 (1 in 3)
	Female	5.6 (1 in 18)	6.2 (1 in 16)	10.0 (1 in 10)	26.0 (1 in 4)	37.7 (1 in 3)
Breast	Female	2.0 (1 in 51)	2.3 (1 in 43)	3.5 (1 in 29)	6.7 (1 in 15)	12.4 (1 in 8)
Colon & rectum	Male	0.4 (1 in 272)	0.7 (1 in 143)	1.2 (1 in 87)	3.3 (1 in 30)	4.4 (1 in 23)
	Female	0.3 (1 in 292)	0.5 (1 in 190)	0.8 (1 in 123)	3.0 (1 in 33)	4.1 (1 in 25)
Kidney & renal pelvis	Male	0.2 (1 in 440)	0.4 (1 in 280)	0.6 (1 in 155)	1.4 (1 in 73)	2.1 (1 in 47)
	Female	0.2 (1 in 665)	0.2 (1 in 575)	0.3 (1 in 319)	0.7 (1 in 135)	1.2 (1 in 82)
Leukemia	Male	0.3 (1 in 396)	0.2 (1 in 570)	0.4 (1 in 259)	1.4 (1 in 72)	1.8 (1 in 56)
	Female	0.2 (1 in 508)	0.1 (1 in 876)	0.2 (1 in 434)	0.9 (1 in 112)	1.3 (1 in 80)
Lung & bronchus	Male	0.1 (1 in 719)	0.6 (1 in 158)	1.8 (1 in 56)	6.0 (1 in 17)	6.7 (1 in 15)
	Female	0.1 (1 in 673)	0.6 (1 in 178)	1.4 (1 in 72)	4.7 (1 in 21)	5.9 (1 in 17)
Melanoma of the skin‡	Male	0.5 (1 in 215)	0.5 (1 in 186)	1.0 (1 in 104)	2.7 (1 in 37)	3.7 (1 in 27)
	Female	0.7 (1 in 150)	0.4 (1 in 238)	0.5 (1 in 191)	1.1 (1 in 87)	2.5 (1 in 40)
Non-Hodgkin lymphoma	Male	0.3 (1 in 382)	0.3 (1 in 350)	0.6 (1 in 176)	1.8 (1 in 54)	2.4 (1 in 42)
	Female	0.2 (1 in 548)	0.2 (1 in 484)	0.4 (1 in 247)	1.4 (1 in 74)	1.9 (1 in 54)
Prostate	Male	0.2 (1 in 437)	1.7 (1 in 59)	4.6 (1 in 22)	7.9 (1 in 13)	11.2 (1 in 9)
Thyroid	Male	0.2 (1 in 513)	0.1 (1 in 764)	0.2 (1 in 584)	0.2 (1 in 417)	0.6 (1 in 156)
	Female	0.8 (1 in 122)	0.4 (1 in 268)	0.3 (1 in 286)	0.4 (1 in 262)	1.8 (1 in 55)
Uterine cervix	Female	0.3 (1 in 366)	0.1 (1 in 835)	0.1 (1 in 938)	0.2 (1 in 628)	0.6 (1 in 162)
Uterine corpus	Female	0.3 (1 in 333)	0.6 (1 in 164)	1.0 (1 in 102)	1.3 (1 in 75)	2.9 (1 in 35)

*For those who are free of cancer at the beginning of each age interval. †All sites excludes basal and squamous cell skin cancers and in situ cancers except urinary bladder. ‡Statistic is for non-Hispanic whites.

Source: DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.6. Statistical Research and Applications Branch, National Cancer Institute, 2018. srab.cancer.gov/devcan.

Please note: The probability of developing cancer for additional sites, as well as the probability of cancer death, can be found in Supplemental Data at cancer.org/research/cancerfactsstatistics/index.

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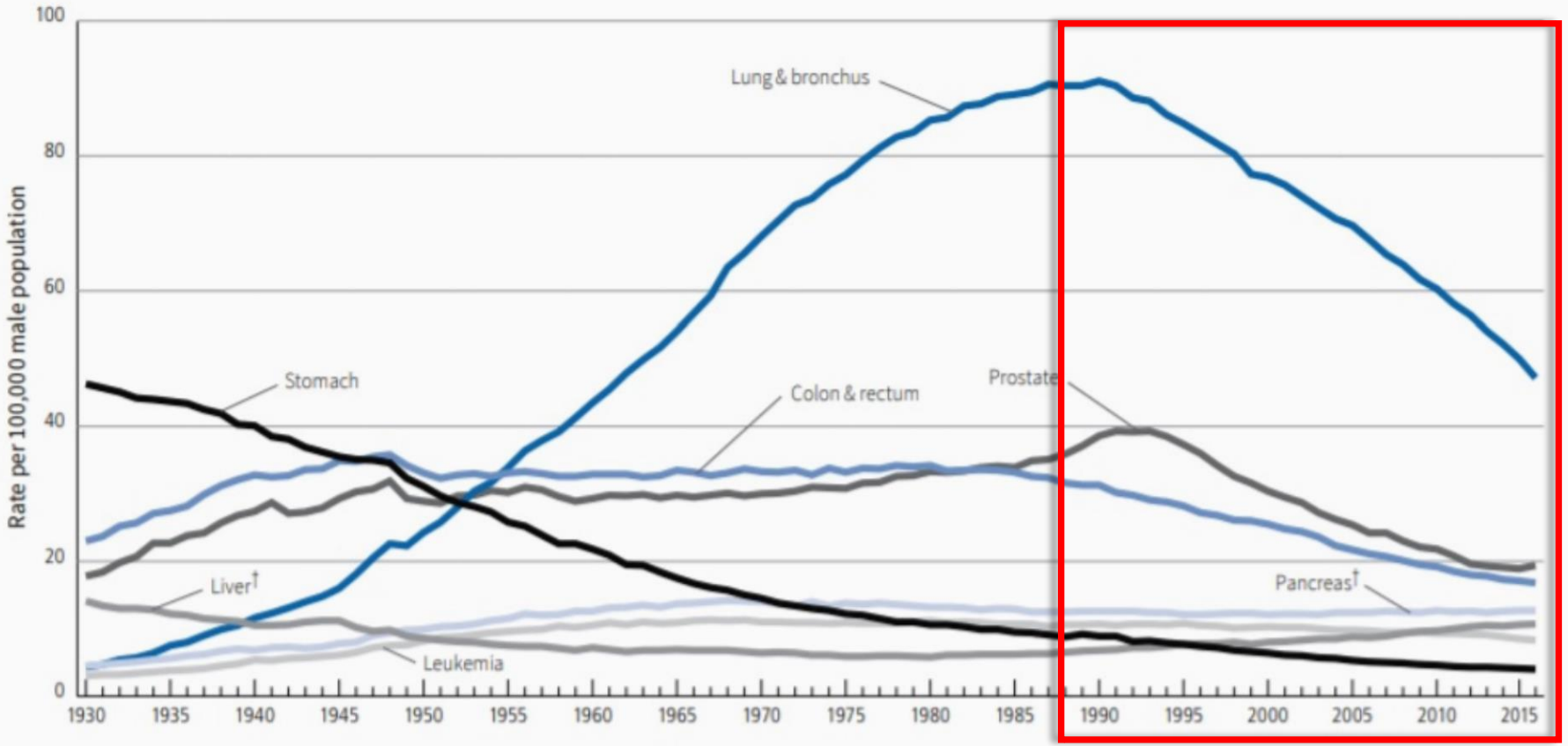
Cancer Facts & Figures

2019

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2016



*Per 100,000, age adjusted to the 2000 US standard population. †Mortality rates for pancreatic and liver cancers are increasing.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancers of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2016, National Center for Health Statistics, Centers for Disease Control and Prevention.

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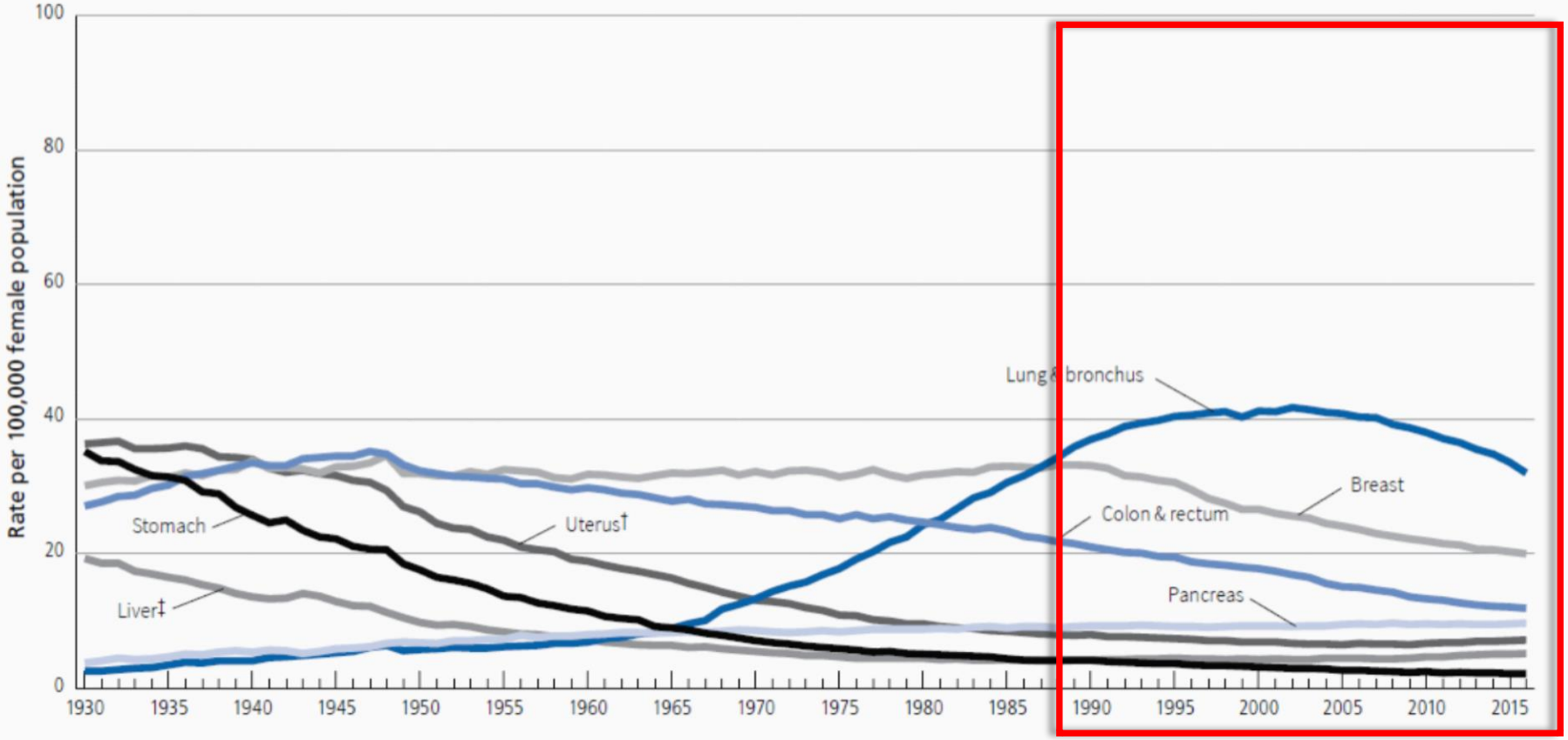
Figure 2. Trends in Age-adjusted Cancer Death Rates* by Site, Females, US, 1930-2016



*Per 100,000, age adjusted to the 2000 US standard population. Rates exclude deaths in Puerto Rico and other US territories. †Uterus refers to uterine cervix and uterine corpus combined. ‡The mortality rate for liver cancer is increasing.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancers of the liver, lung and bronchus, colon and rectum, and uterus are affected by these coding changes.

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2016, National Center for Health Statistics, Centers for Disease Control and Prevention.

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The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 AUGUST 4, 2011 VOL. 365 NO. 5

Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

The National Lung Screening Trial Research Team*

%20

ABSTRACT

BACKGROUND

The aggressive and heterogeneous nature of lung cancer has thwarted efforts to reduce mortality from this cancer through the use of screening. The advent of low-dose helical computed tomography (CT) altered the landscape of lung-cancer screening, with studies indicating that low-dose CT detects many tumors at early stages. The National Lung Screening Trial (NLST) was conducted to determine whether screening with low-dose CT could reduce mortality from lung cancer.

The members of the writing team (who are listed in the Appendix) assume responsibility for the integrity of the article. Address reprint requests to Dr. Christine D. Berg at the Early Detection Research Group, Division of Cancer Prevention, National Cancer Institute, 6130 Executive Blvd., Suite 3112, Bethesda, MD 20892-7346, or at bergc@mail.nih.gov.

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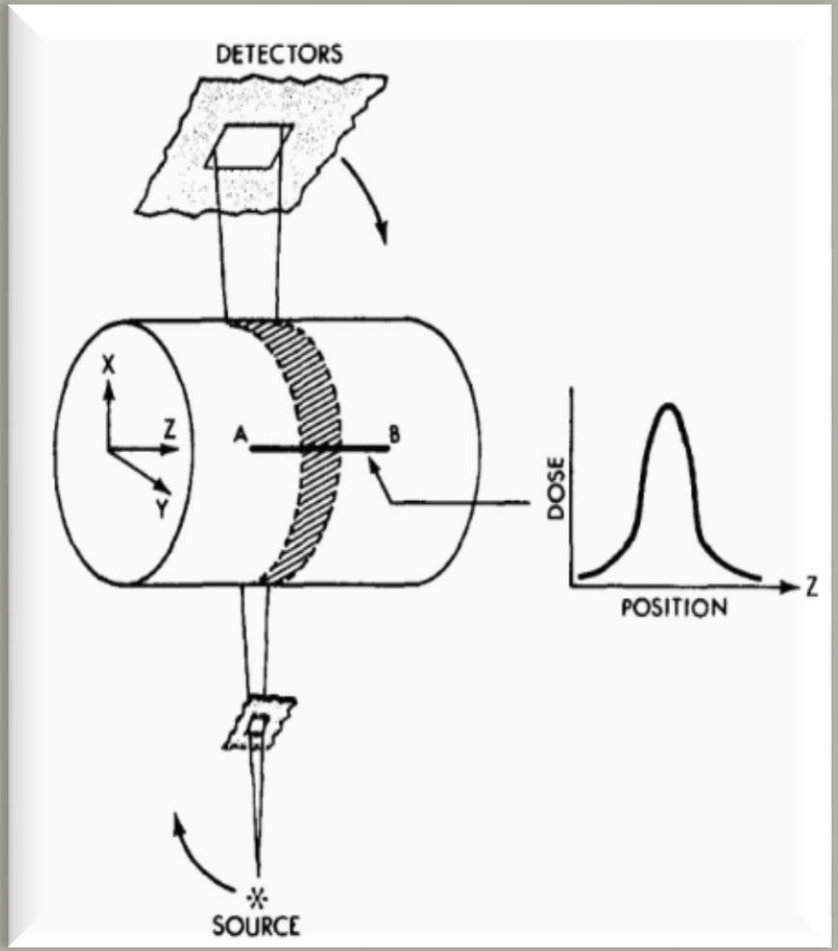
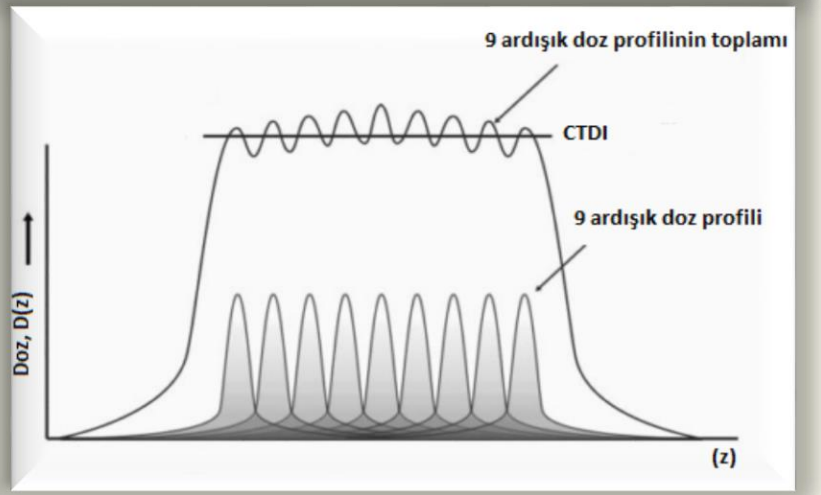
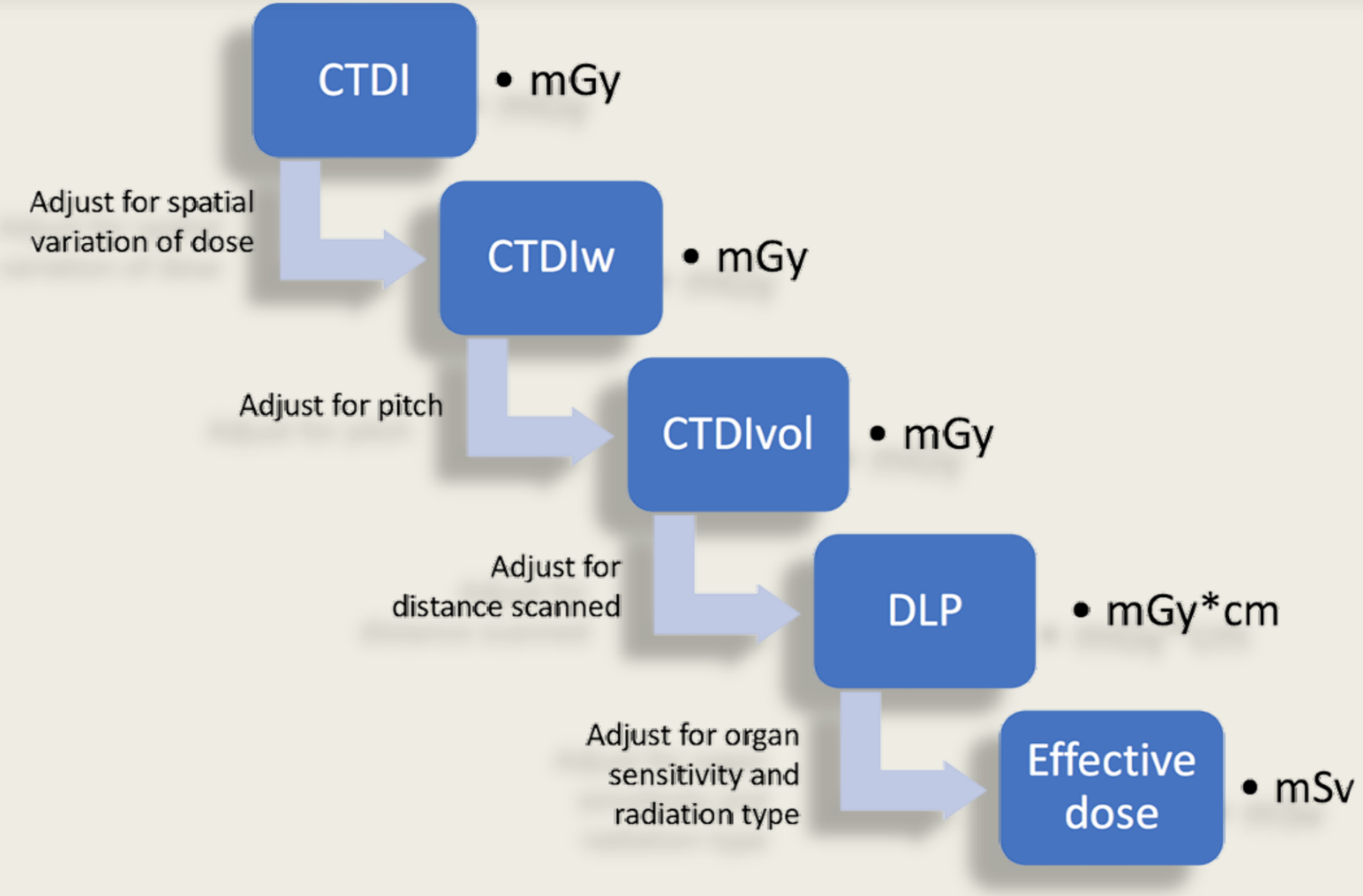
BT'de Doz Kavramı : $CTDI_{vol}$, DLP, E





$$CTDI = \frac{1}{nT} \int_{-\infty}^{+\infty} D(z)\, dz$$

BT'de Doz Kavramı : $CTDI_{vol}$, DLP, E



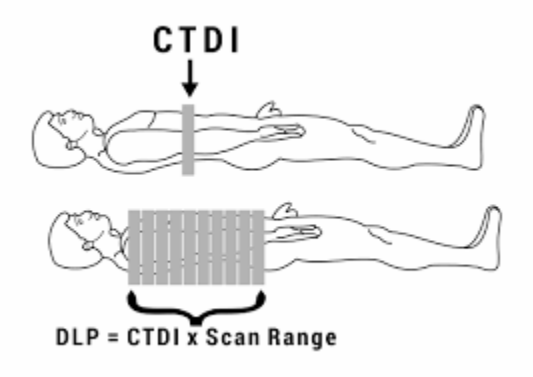
BT'de Doz Kavramı : $CTDI_{vol}$, DLP, E

Exam Information

Study ID:	94009
Time:	Feb 07, 2014, 21:30:05
Total DLP:	403.1 mGy*cm

Dose

#	Description	Scan Mode	mAs	kV	CTDIvol [mGy]	DLP [mGy*cm]	Phantom Type[cm]
1		Surview	1	120	0.08	3.8	BODY 32 CM
2		Helical	100	120	6.47	399.3	BODY 32 CM



- DLP = $CTDI_{vol}$ x Tarama Uzunluğu
- Etkin Doz (E) = DLP x k

BT’de Dozu Etkileyen Faktörler

- Bu görüntüyü gerçekten istiyor muyuz ?
- Ne kadar iyi bir görüntü istiyoruz ?

BT’de Dozu Etkileyen Faktörler

BT'de Dozu Etkileyen Faktörler

- Tüp Akımı
- Pitch faktörü
- Tüp Dönüş Süresi

} Etkin Tüp Akımı (mAs)

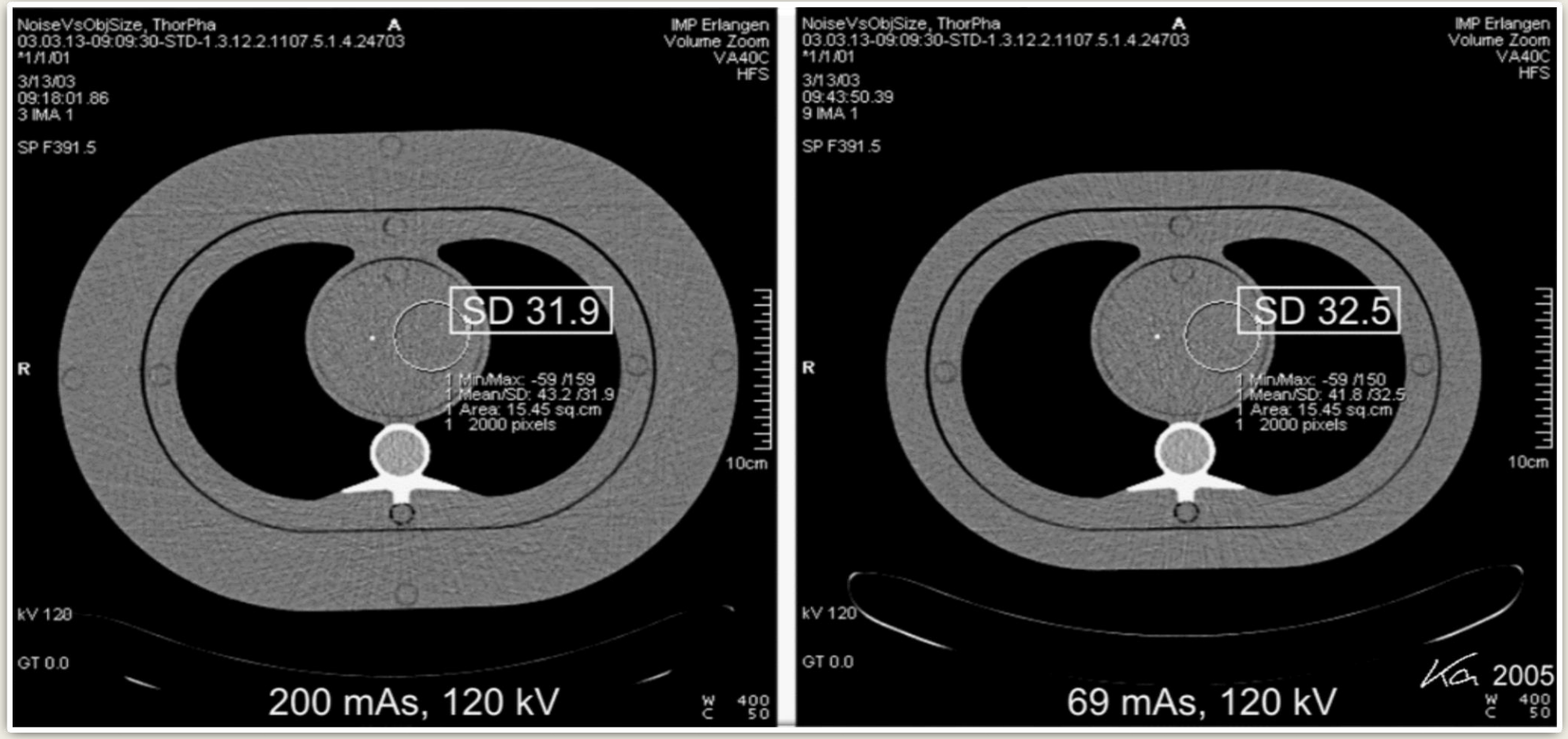
- kVp
- Görüntü İşleme Algoritması
- Filtrasyon
- Dinamik kolimasyon
- Tarama Uzunluğu
- Kesit Kalınlığı (dedektör konfigürasyonu)

BT’de Doz Azaltımı Nasıl Sağlanabilir ?

- Cihaz üreticileri
- Kullanıcılar (radyoloji uzmanı ve teknisyenler)
- Ulusal ve Uluslararası Kurum/Kuruluşlar/Otoriteler

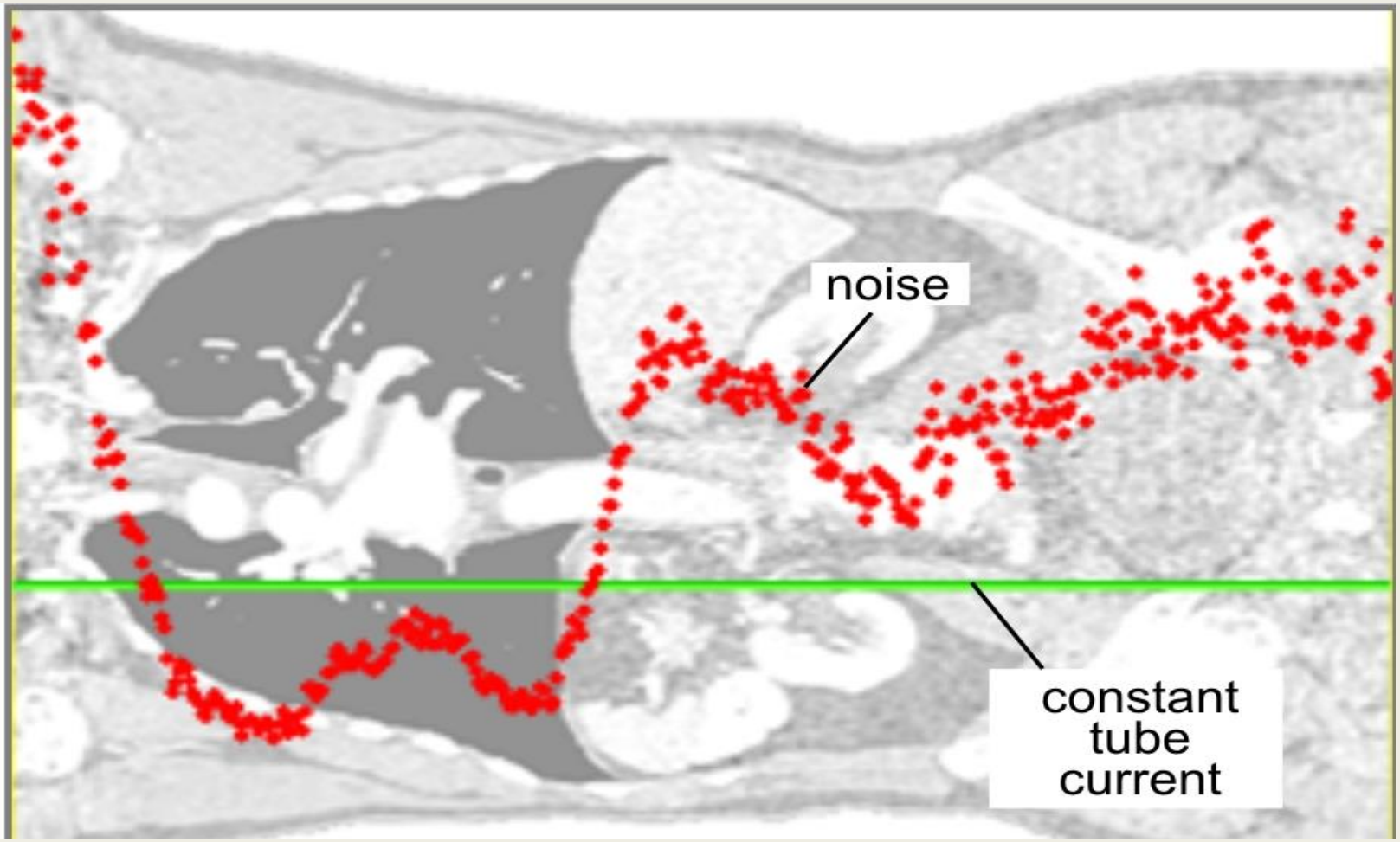
BT’de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Akımı



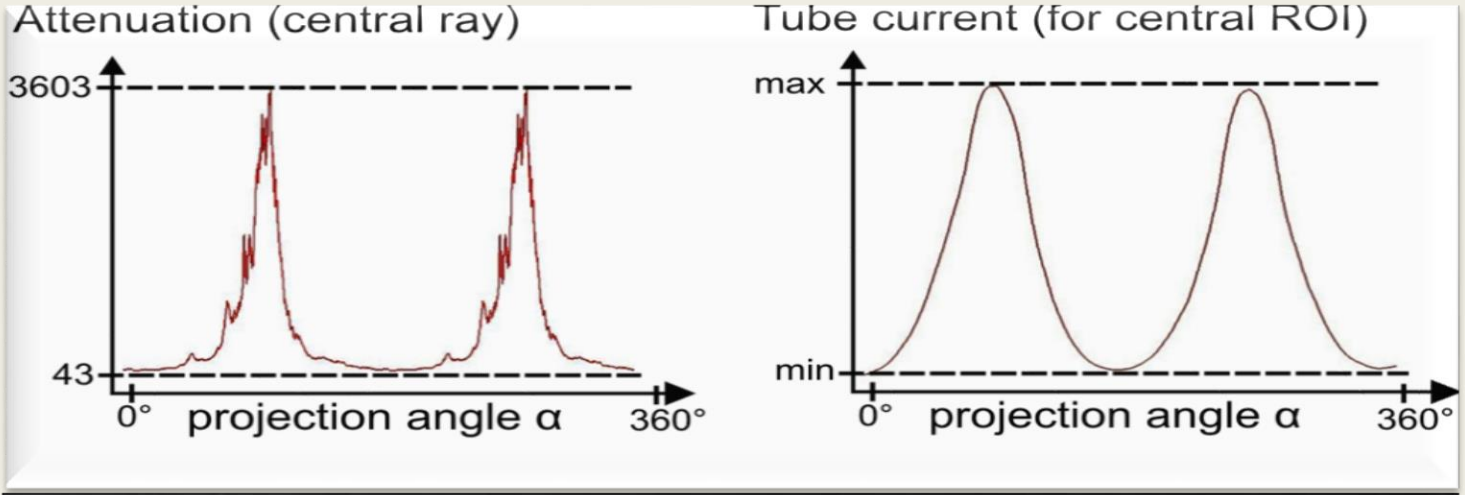
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

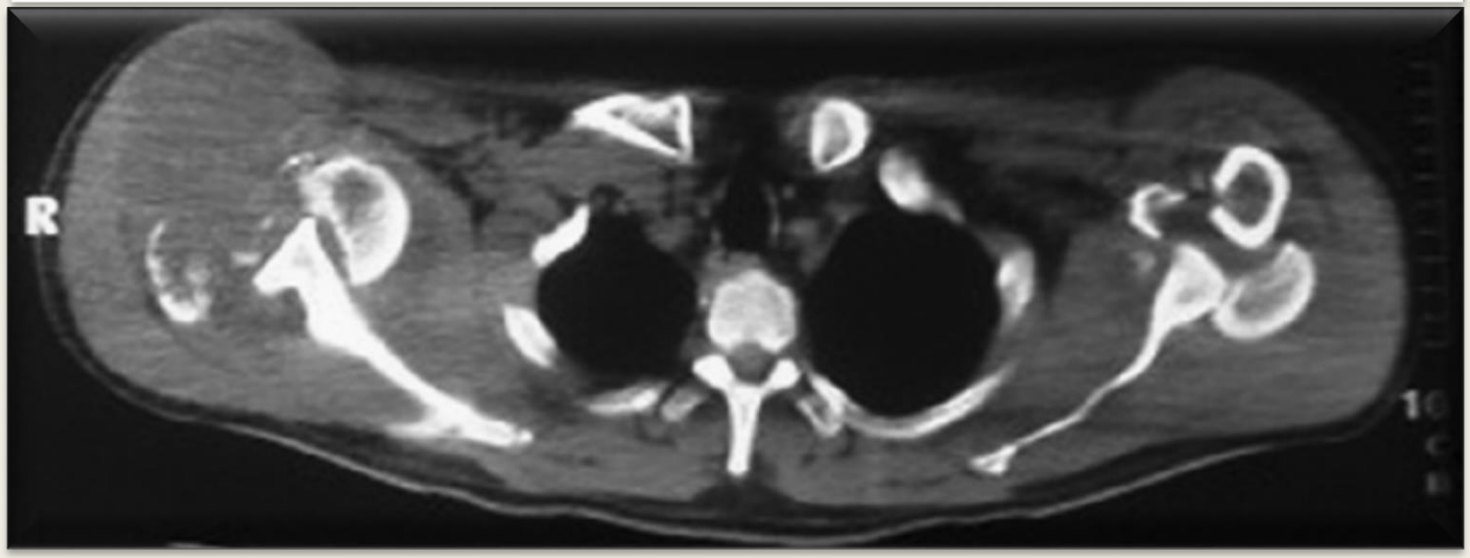
Tüp Akımı



BT'de Doz Azaltımı Nasıl Sağlanabilir ?

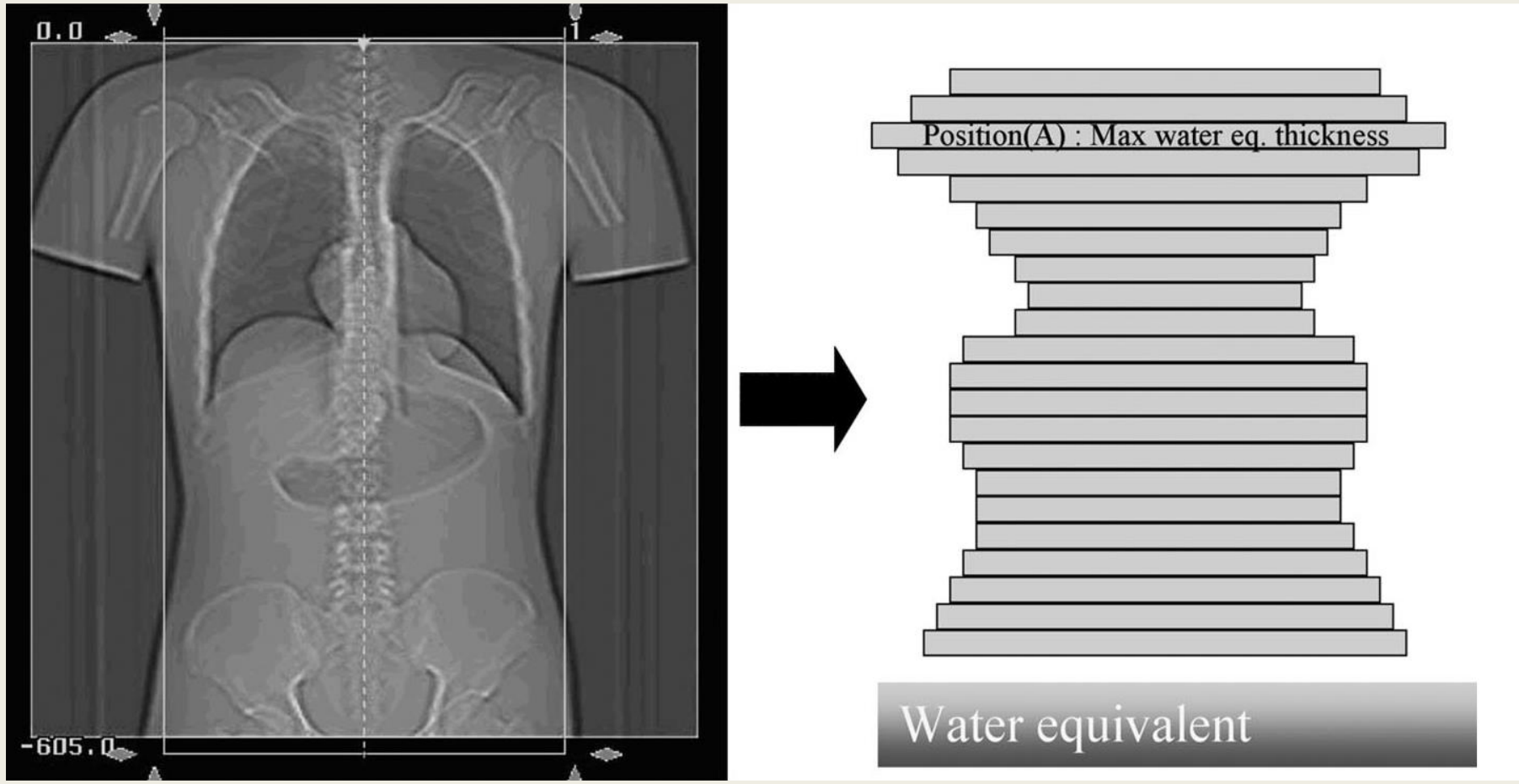
Otomatik Tüp Akımı Modülasyonu (x-y)





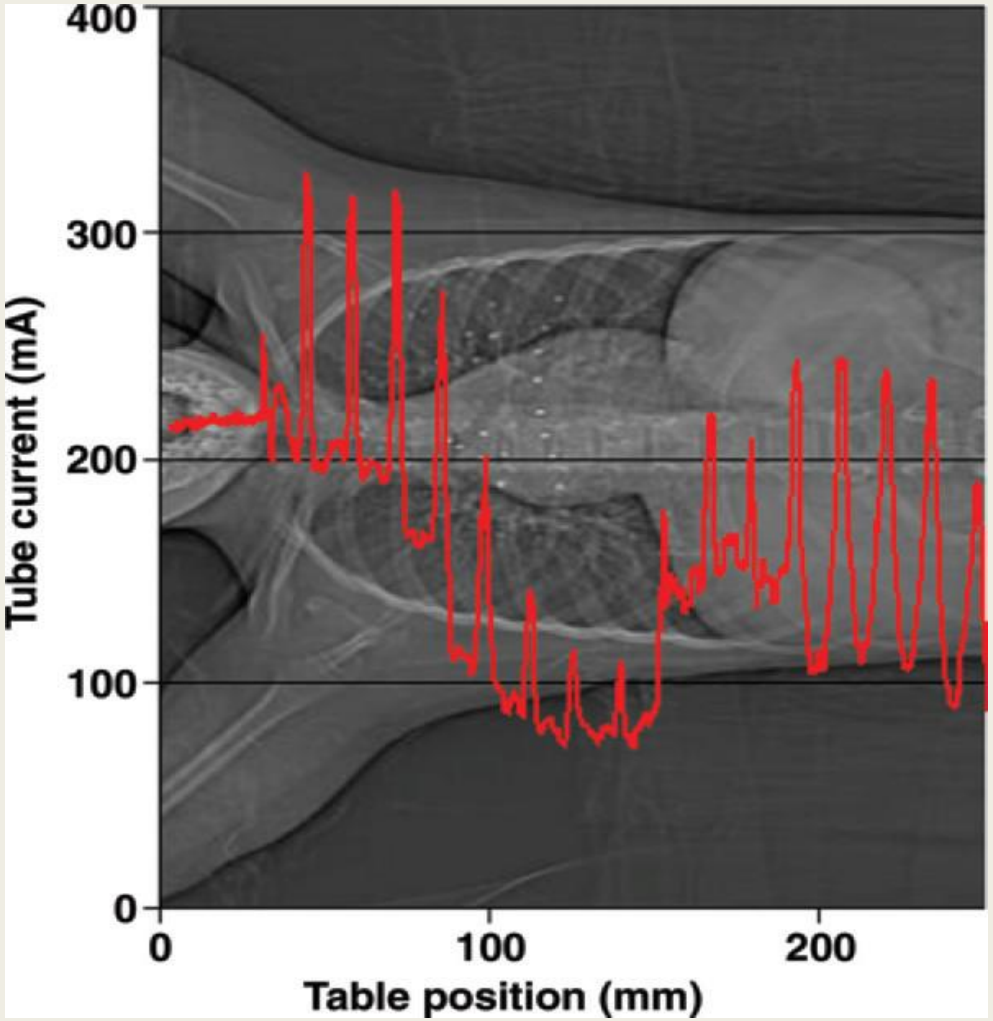
BT’de Doz Azaltımı Nasıl Sağlanabilir ?

Otomatik Tüp Akımı Modülasyonu (z)



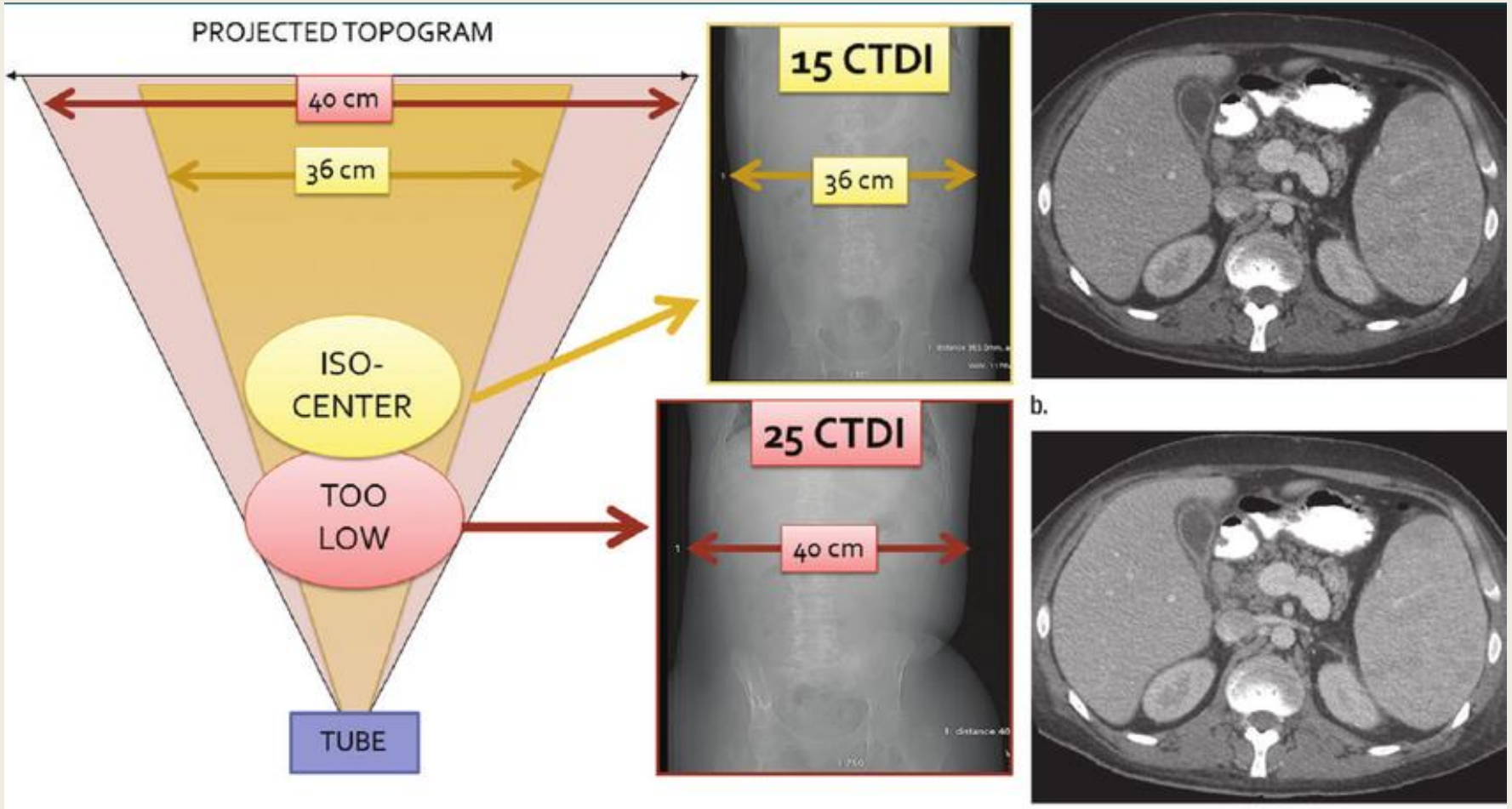
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Otomatik Tüp Akımı Modülasyonu (x-y & z)



BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Otomatik Tüp Akımı Modülasyonu (z)



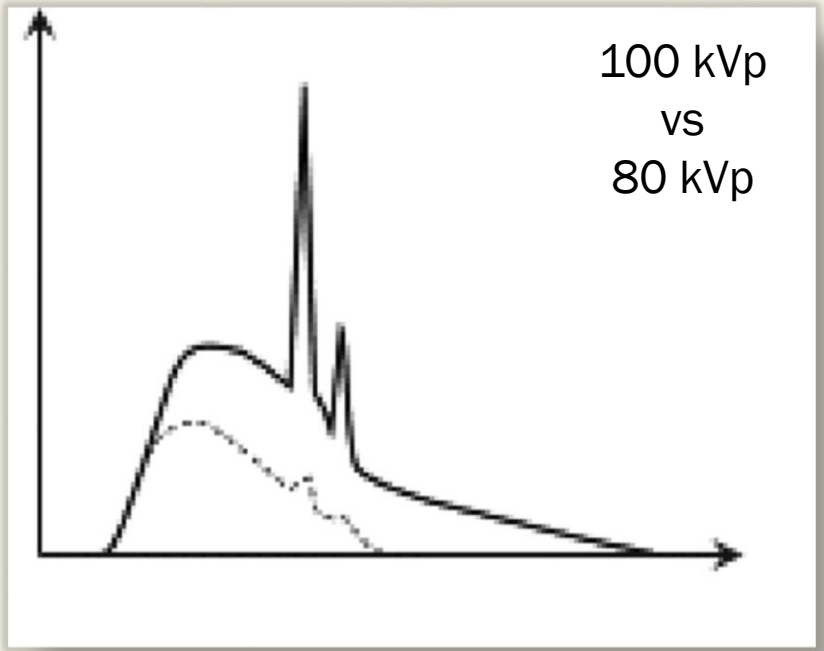
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Voltajı

Tüp voltajındaki değişim iki şeyi değiştirir.

- Ortalama X ışını enerjisi
- X ışını miktarı

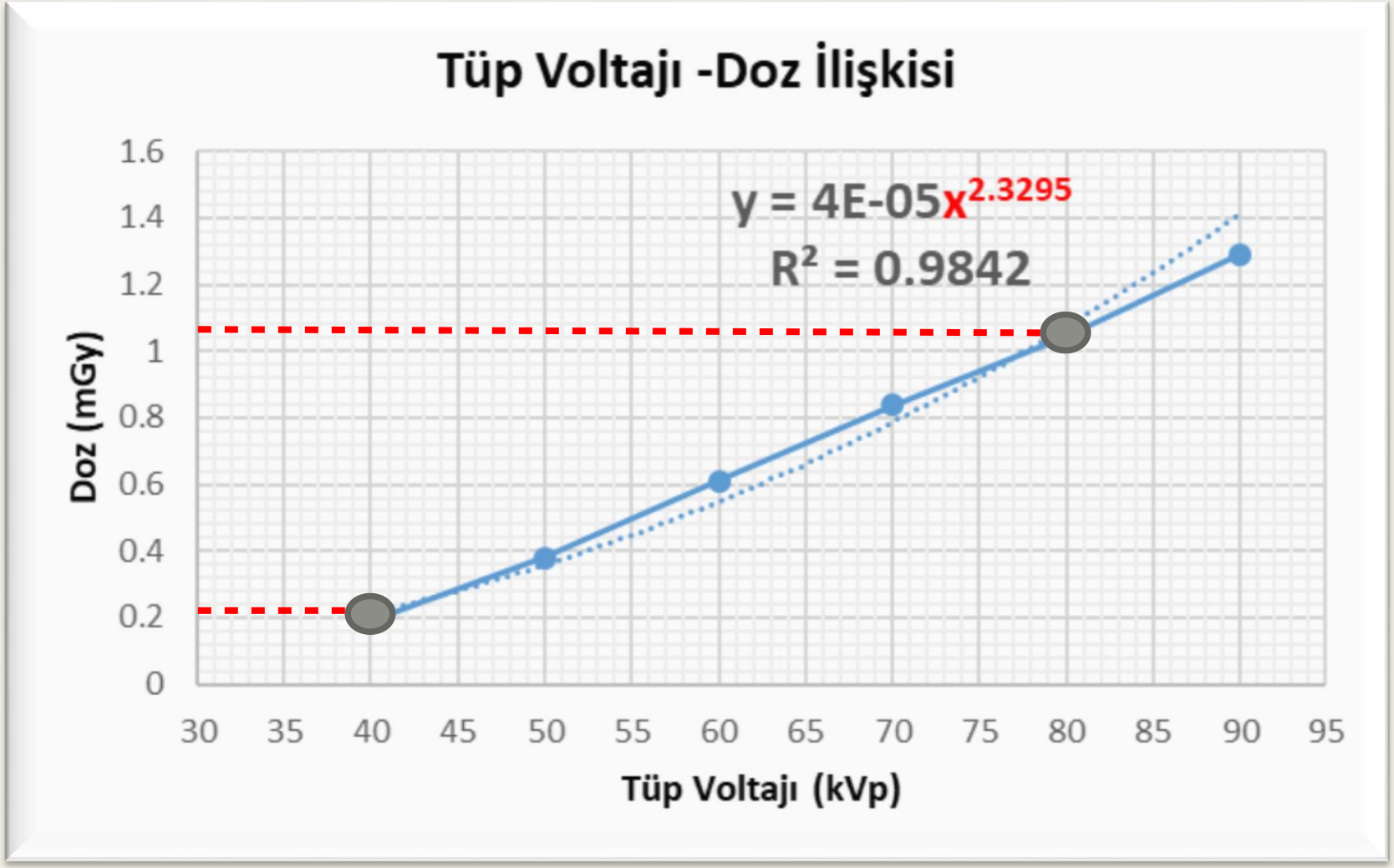
X ışını enerjisi kontrastı doğrudan etkilerken x ışını miktarı da gürültüyü doğrudan etkiler.



Foton Miktarı ⟷ **Tüp Voltajı** ⟷ Foton Giriciliği

BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Voltajı- Doz



BT'de Doz Azaltımı Nasıl Sağlanabilir ?

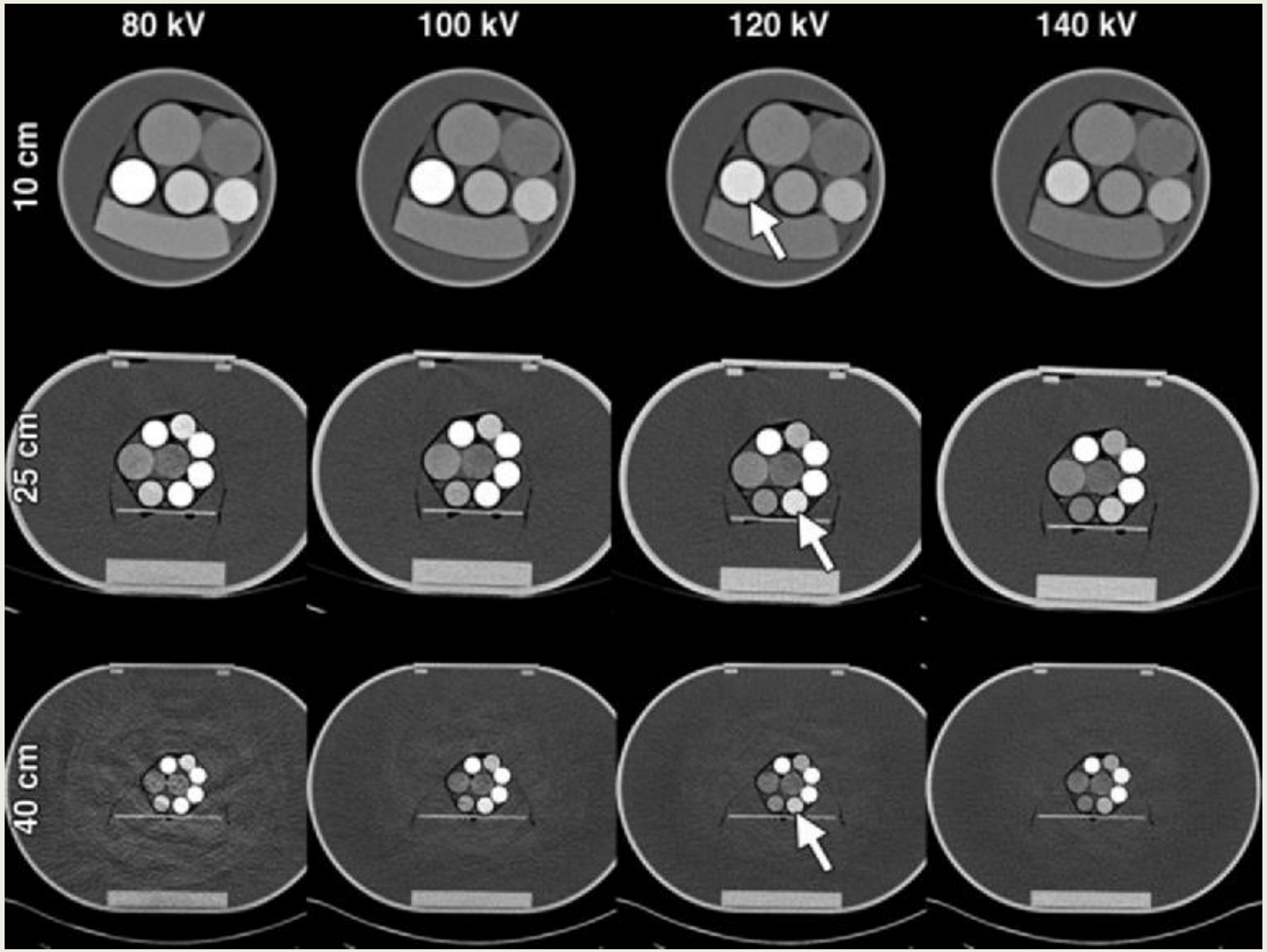
Tüp Voltajı - Kontrast

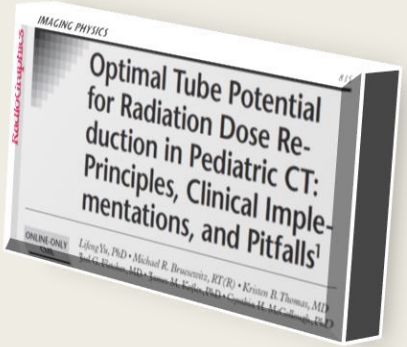
$CTDI_{vol}$

3.9 mGy

6.6 mGy

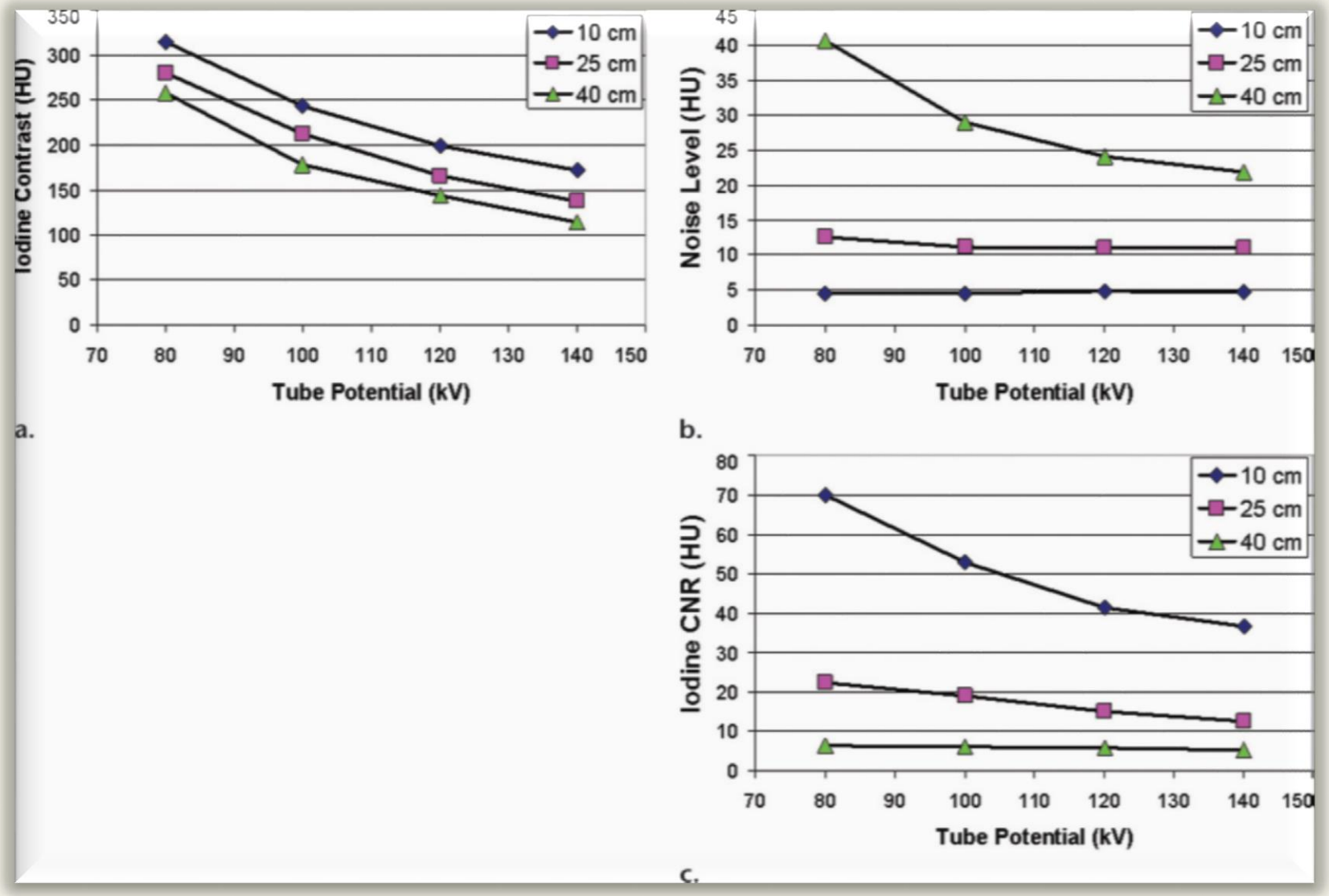
21.4 mGy





BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Voltajı



BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Voltajı

Table 1: Technique Chart for Manual Selection of Optimal Tube Voltage for Routine Contrast-enhanced Abdominal CT on the Basis of Patient Size

Body Mass Index (kg/m²)*	Lateral Width (cm)†	Peak Tube Voltage Setting (kV)	Quality Reference Tube Current–Time Product (mAS)	AEC	Iterative Reconstruction	Gantry Rotation (sec)	Helical Pitch	Section Interval/ Thickness (mm)	Collimation‡
<20	<31	100	241	On	Yes	0.5	0.9	5/5	64 × 0.6
20–25	32–43	100	241	On	Yes	0.5	0.9	5/5	64 × 0.6
26–34	44–53	120	175	On	Yes	0.5	0.9	5/5	64 × 0.6
≥35	>53	140	141	On	Yes	0.5	0.9	5/5	64 × 0.6

Note.—This protocol applies to the latest generation of CT scanners that do not have automated attenuation-based tube voltage selection. Either the body mass index or the lateral width of the patient should be used for manual selection of optimal tube voltage. AEC = automatic exposure control.

*Categories for body mass index used at our institution.

†Categories for lateral width adapted, with permission, from reference 29.

‡The first number is the number of detector rows, and the second number is the collimation thickness in millimeters.

BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Voltajı

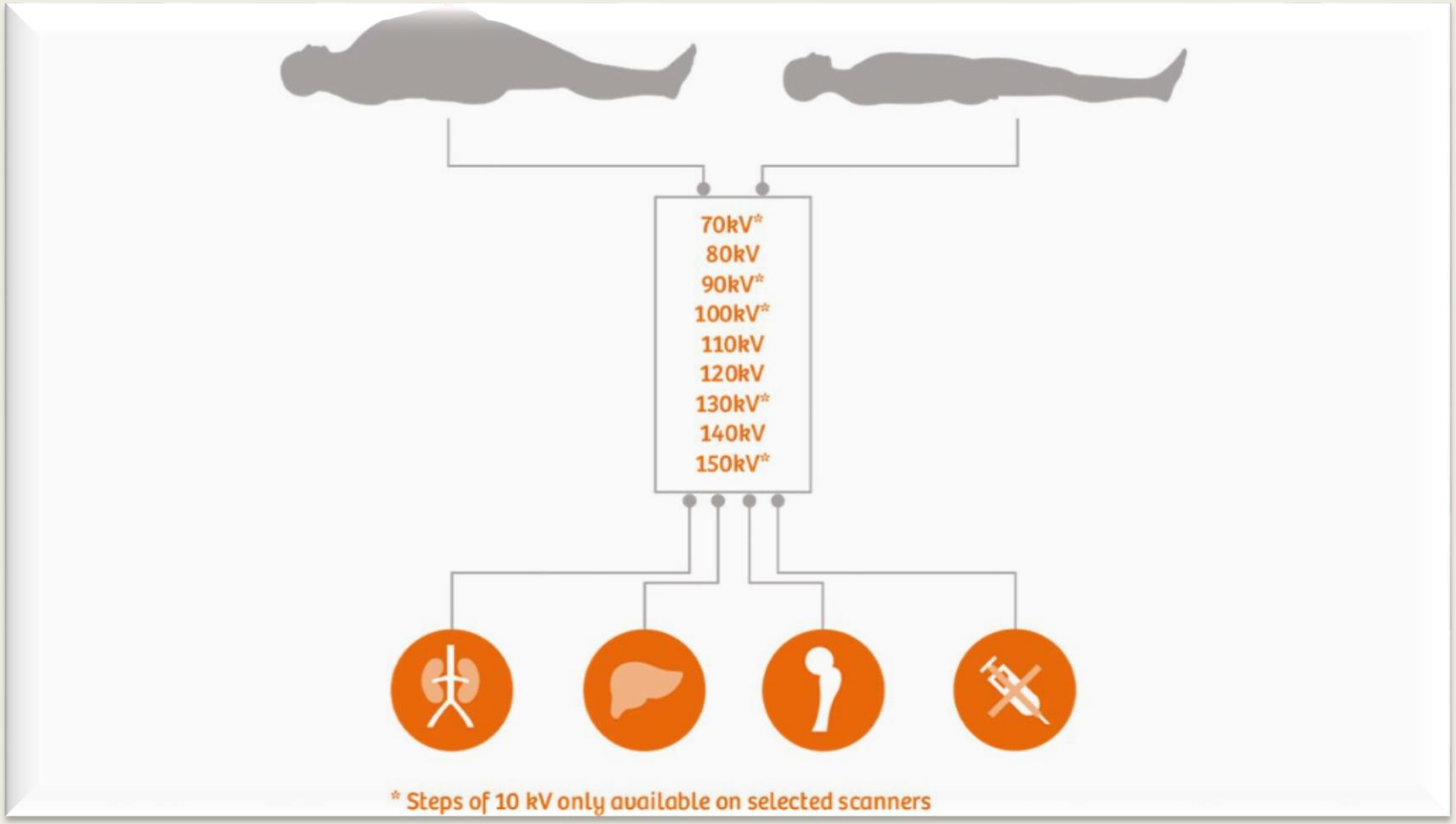
Table 2: Optimal Tube Voltage Selection for Various Types of Abdominal CT Examinations on the Basis of Patient Size and Image Noise Tolerance

				Recommended CT Examinations				
Body Mass Index (kg/m²)*	Lateral Width (cm)†	Image Noise Tolerance‡	Peak Tube Voltage (kV)	Routine Unenhanced CT	Routine Contrast-enhanced CT	CT Urography and CT Angiography of Abdominal Aorta Branch Vessels	CT Enter-ography	CT Angiography of Aorta
<20	<31	Low	100	X	X	X		
		High	80				X	X
20–25	32–43	Low	120	X	X			
		High	100			X	X	X
26–34	44–53	Low	120	X	X			
		High	100			X	X	X
≥35	>53	Any	140	X	X	X§	X§	X§

Note.—When automated tube voltage selection is not available, either the body mass index or the lateral width of the patient should be used for manual selection of optimal tube voltage. X = recommended.
*Categories for body mass index used at our institution.
†Categories for lateral width adapted, with permission, from reference 29.
‡Categories are based on the radiologists' image noise tolerance for a given CT examination at our institution and may vary among different institutions.
§When the body mass index is used for tube voltage selection, consider selecting 120 kV if the body mass index is between 35 and 40 kg/m².

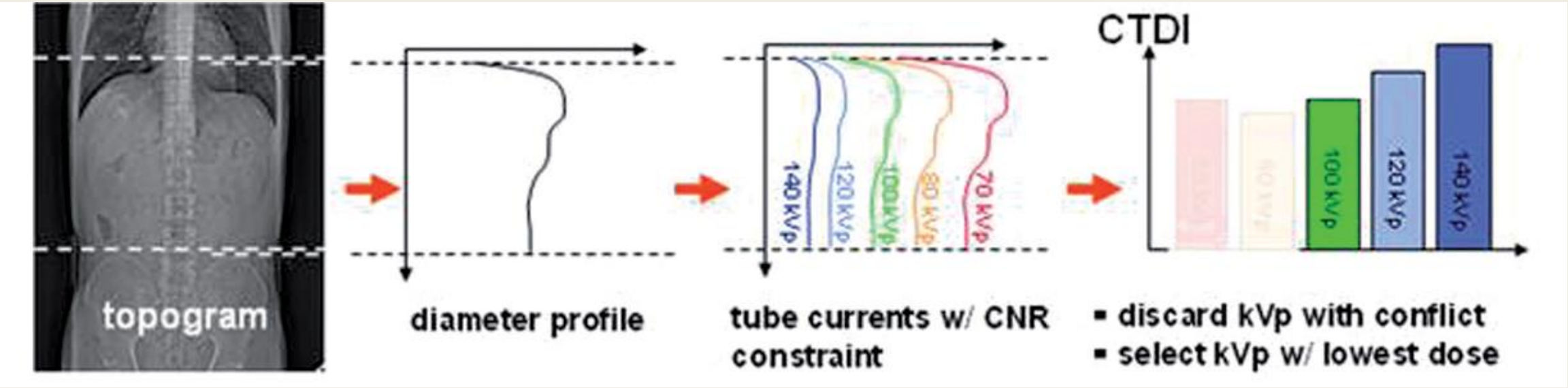
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Otomatik kVp Seçimi



BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Otomatik kVp Seçimi

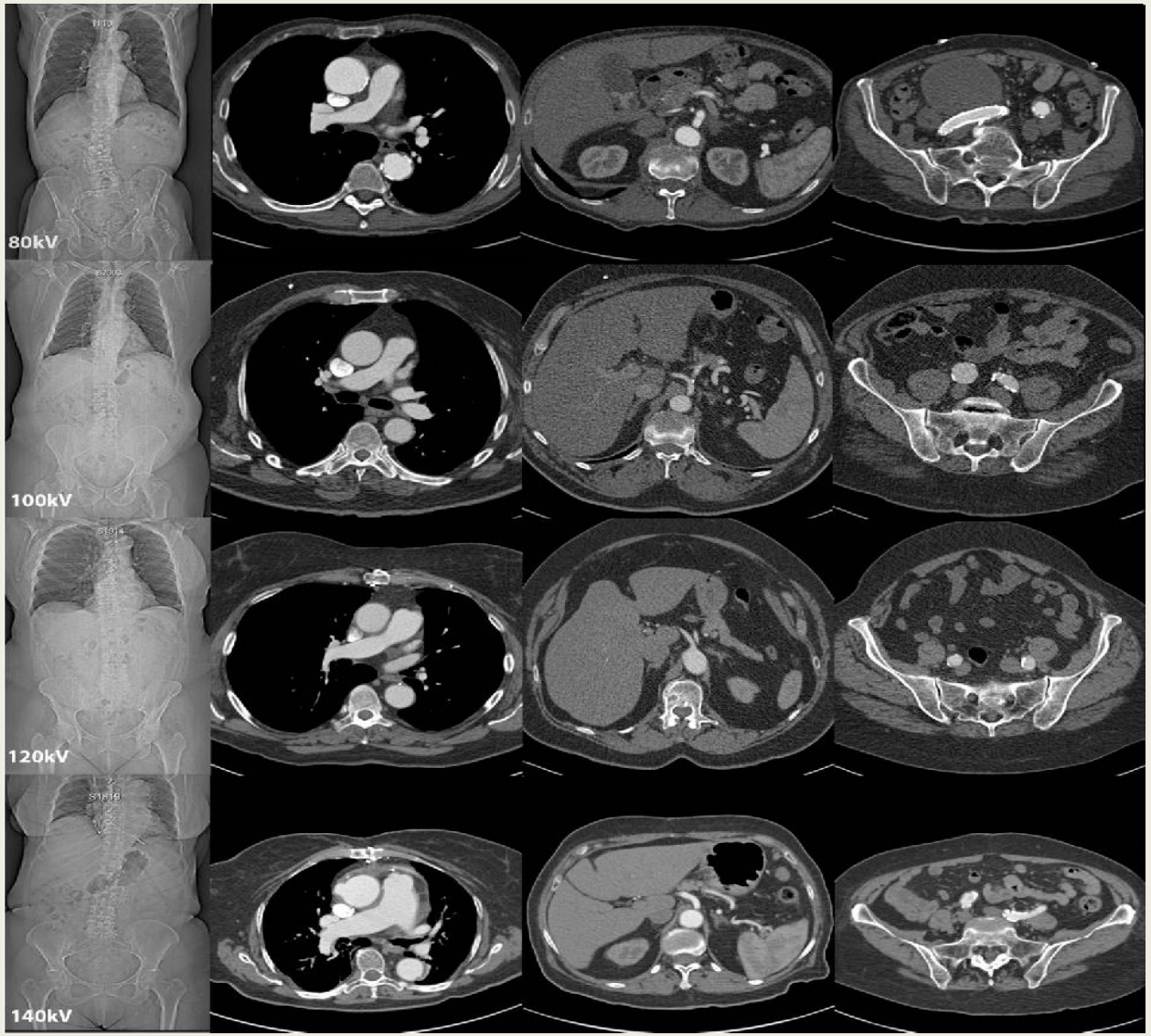


P = I . V

↑ = ↑↑ . ↓

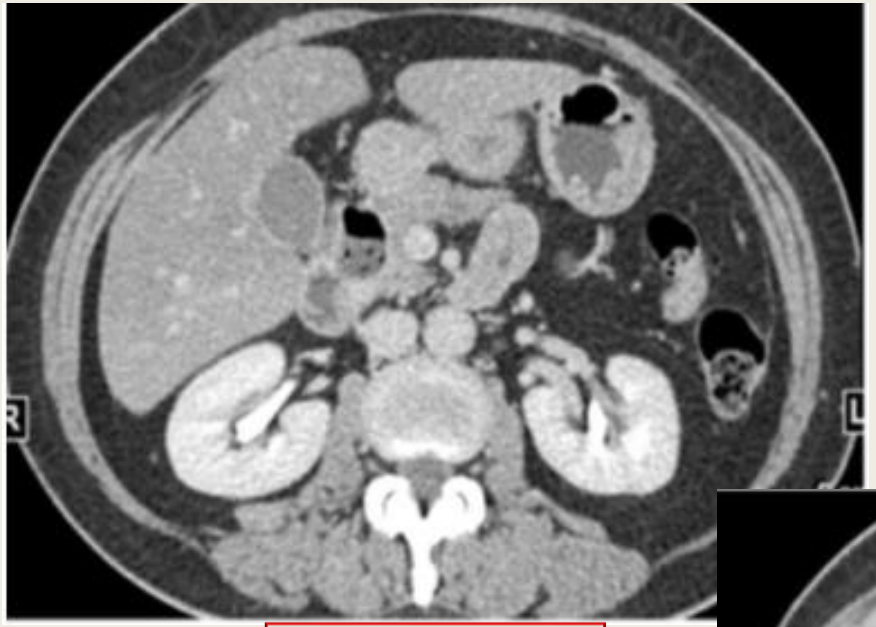
BT’de Doz Azaltımı Nasıl Sağlanabilir ?

Otomatik kVp Seçimi



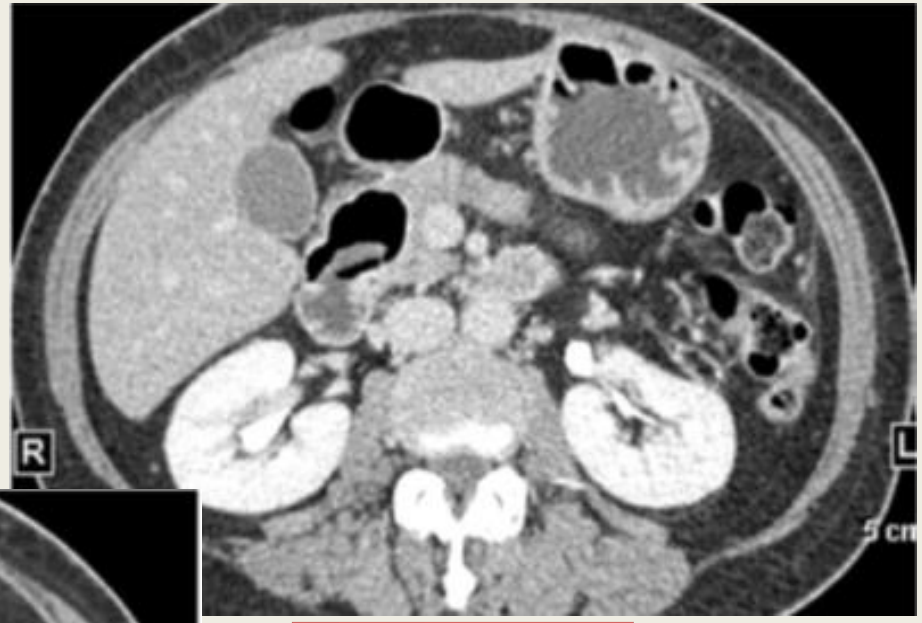
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Tüp Voltajı



120 kVp
FBP
8.5 mSv
NI 14.5 HU
CNR 14.3
SNR 4.3

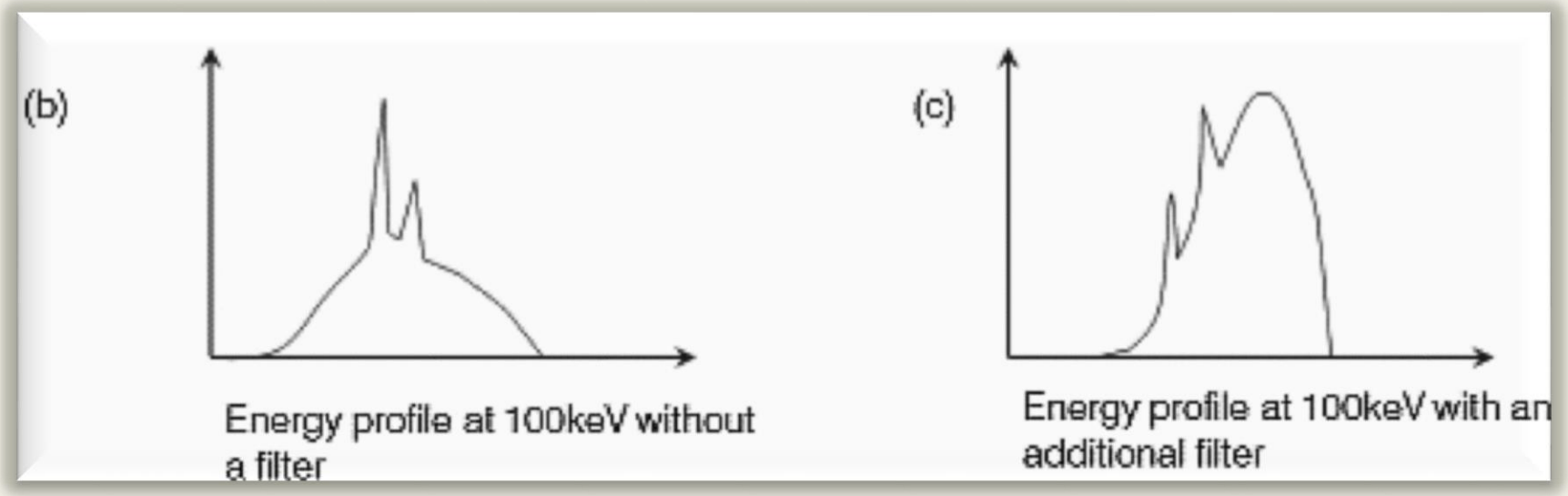
100 kVp
IR
6.4 mSv
NI 10.2 HU
CNR 21.9
SNR 6.6



100 kVp
FBP
6.4 mSv
NI 16.6 HU
CNR 13.4
SNR 4.1

BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Filtrasyon: Tüp Çıkışı Filtresi



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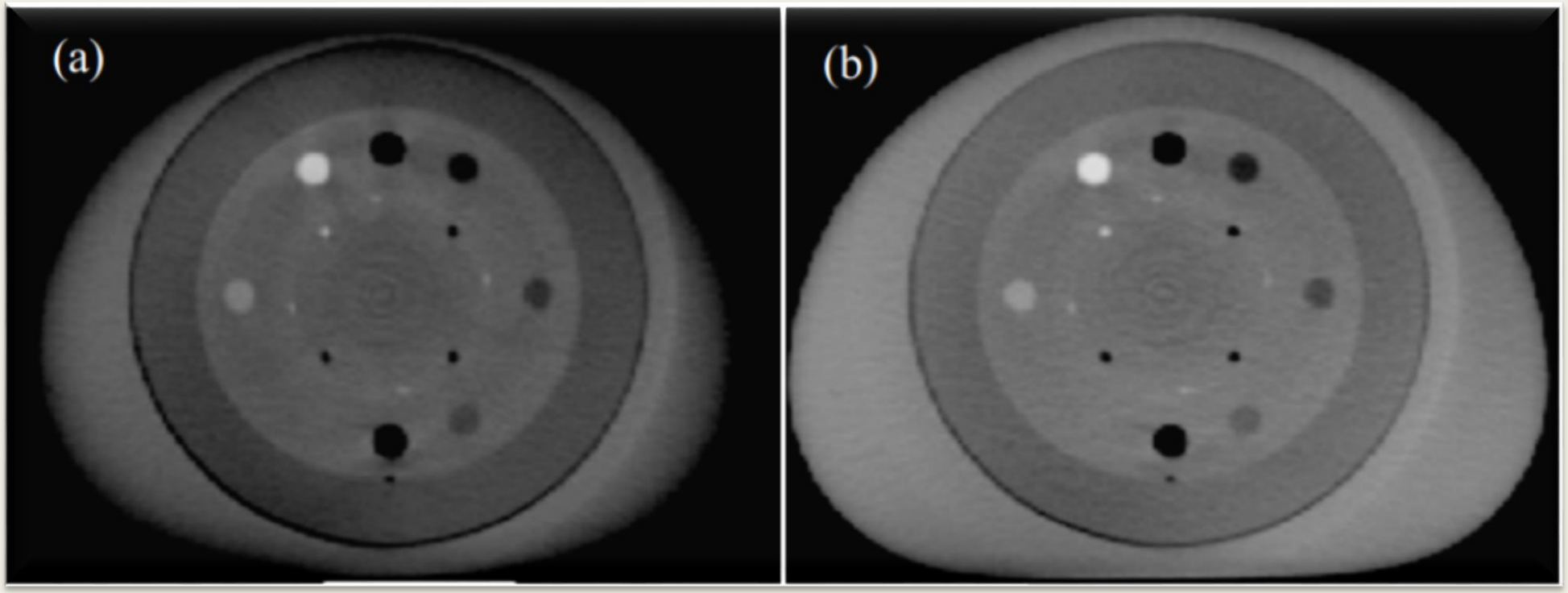
Filtrasyon: Bow-tie Filtre



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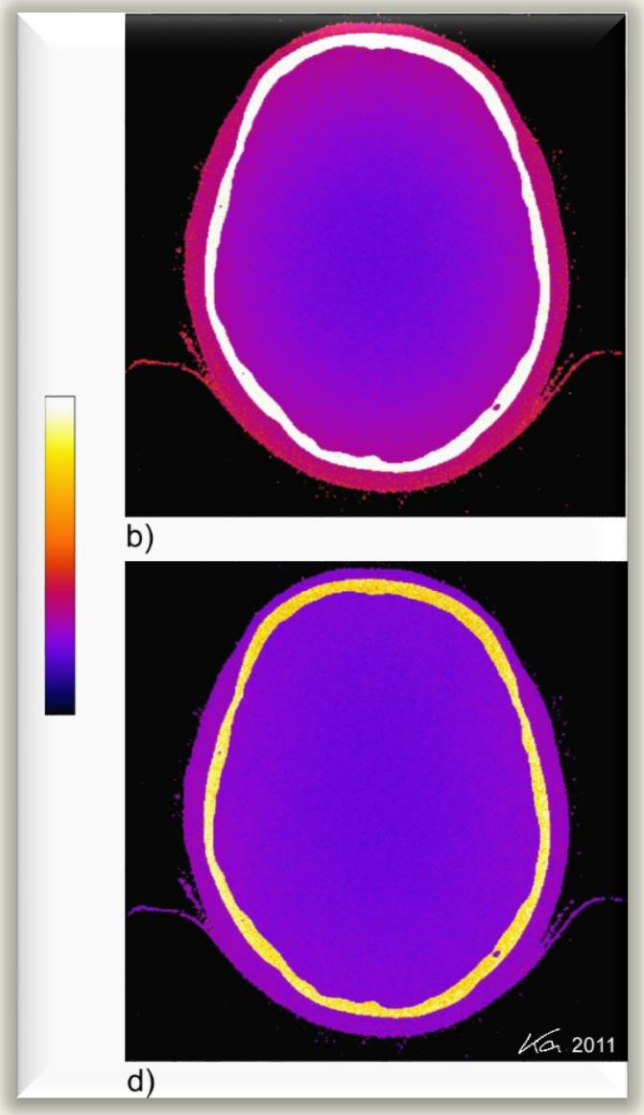
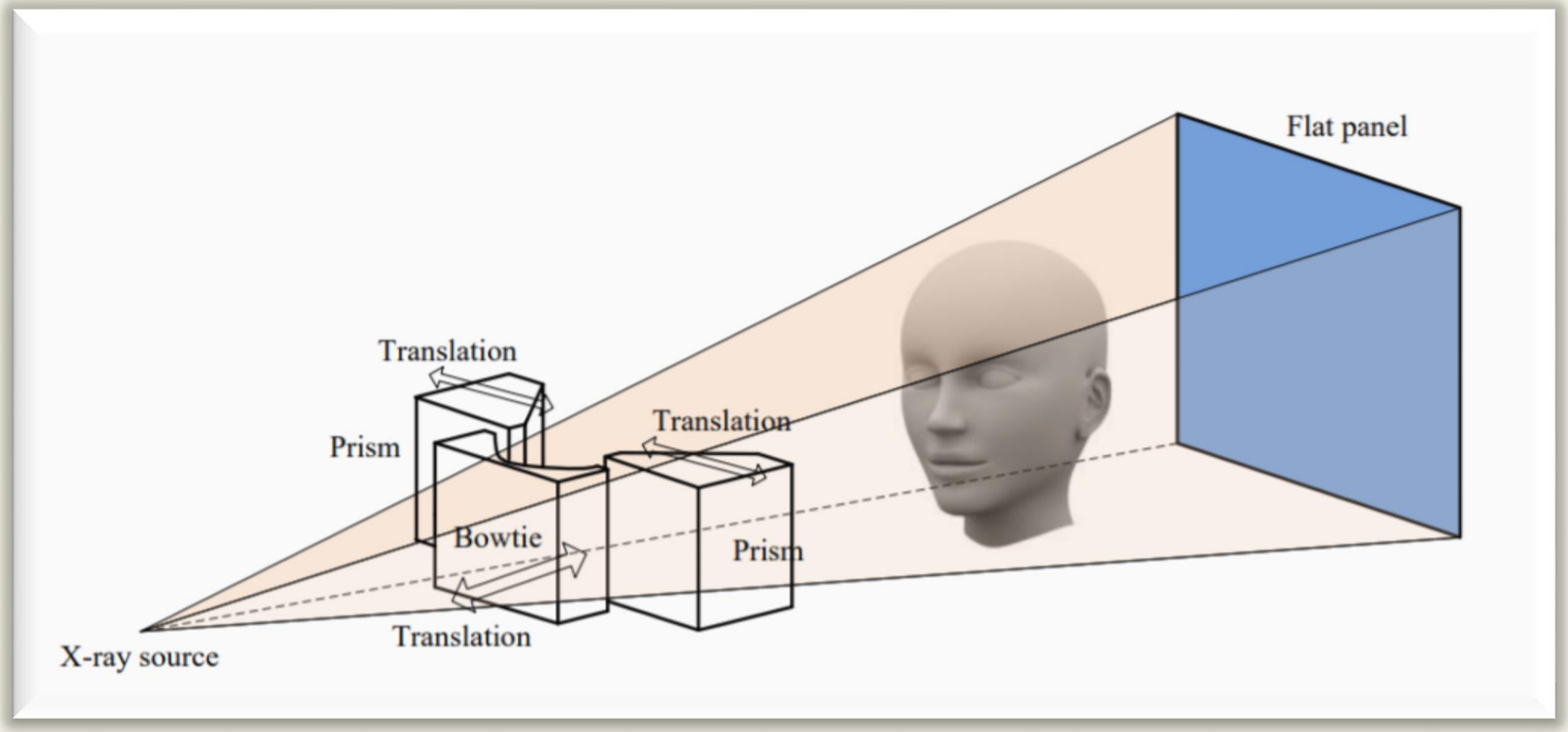
Filtrasyon: Bow-tie Filtre



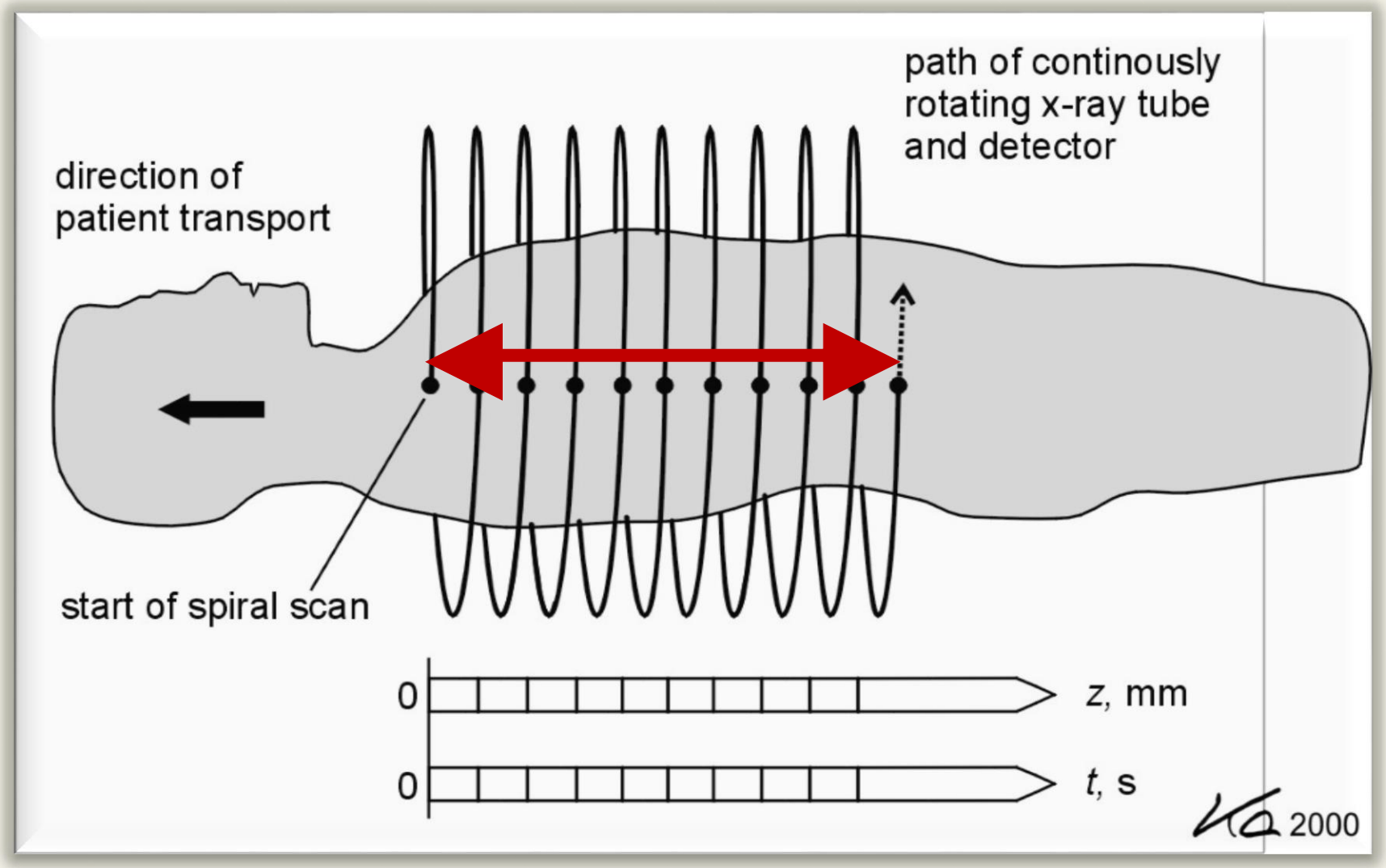
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Filtrasyon: Bow-tie Filtre



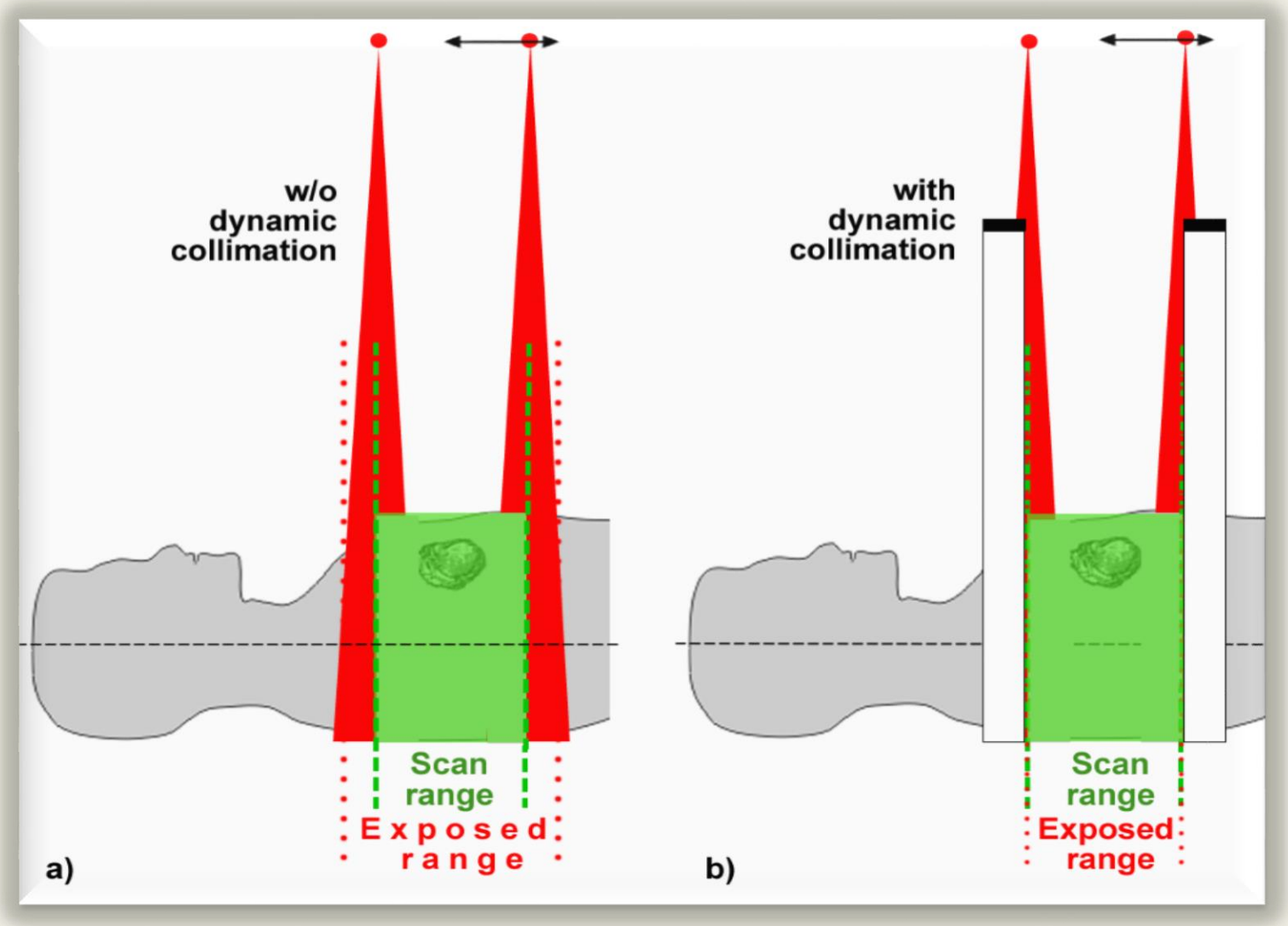
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Dinamik Kolimasyon



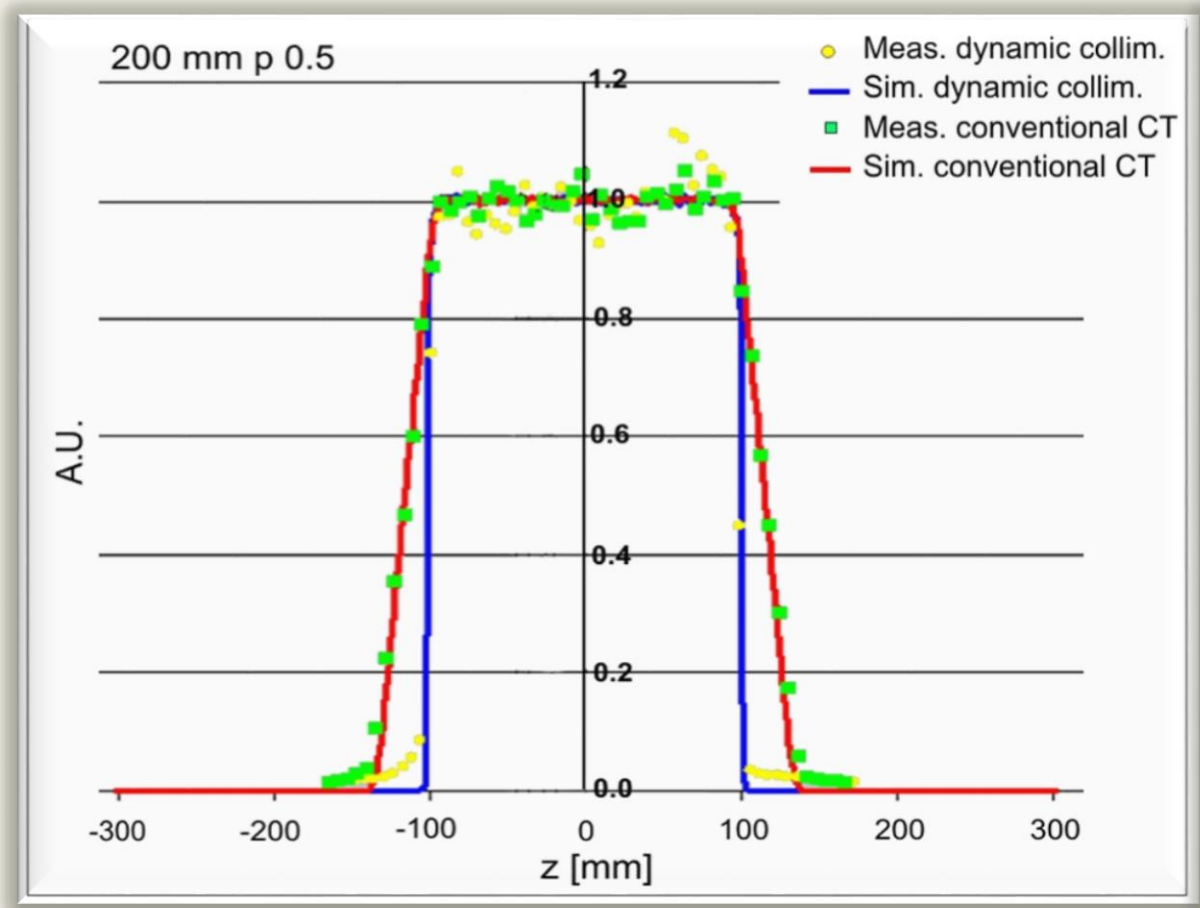
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

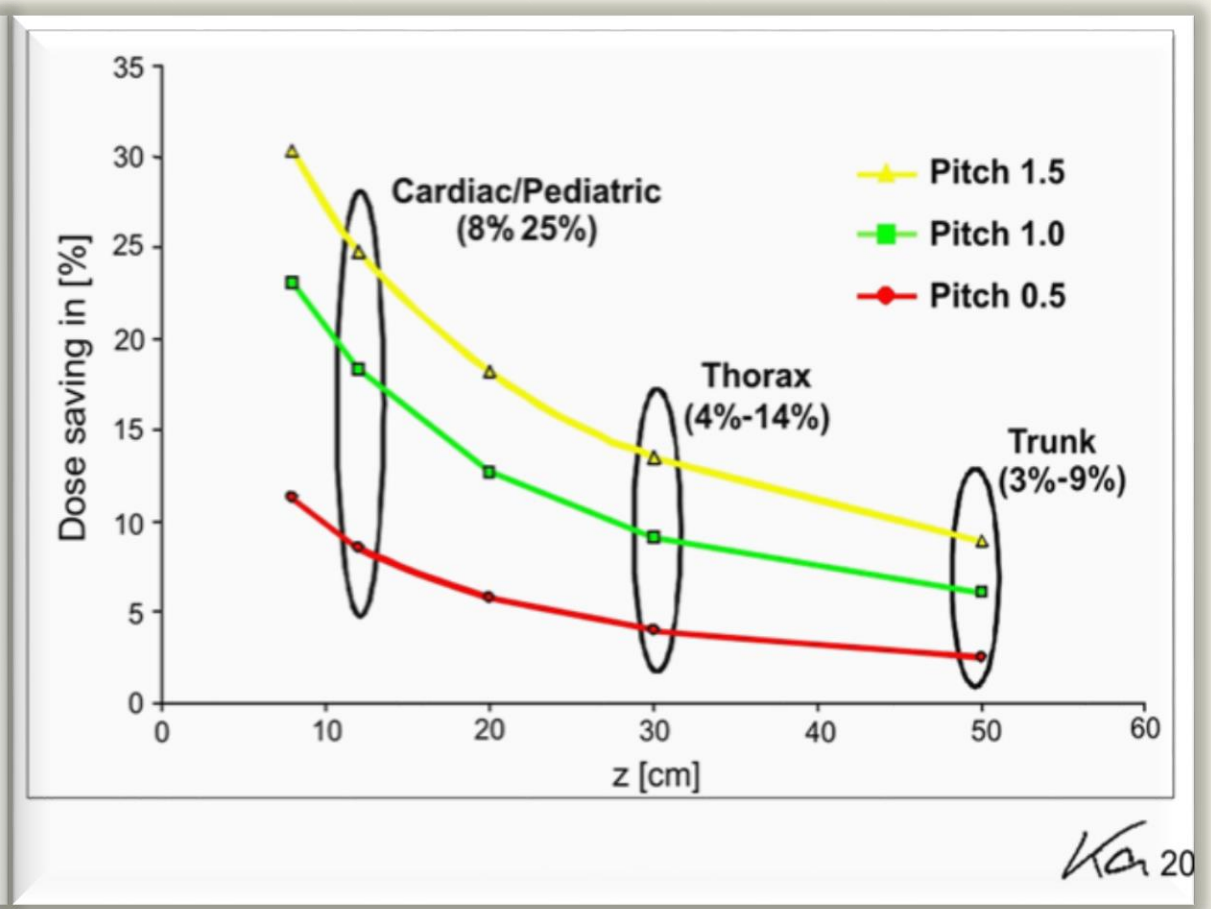
Dinamik Kolimasyon



BT'de Doz Azaltımı Nasıl Sağlanabilir ?

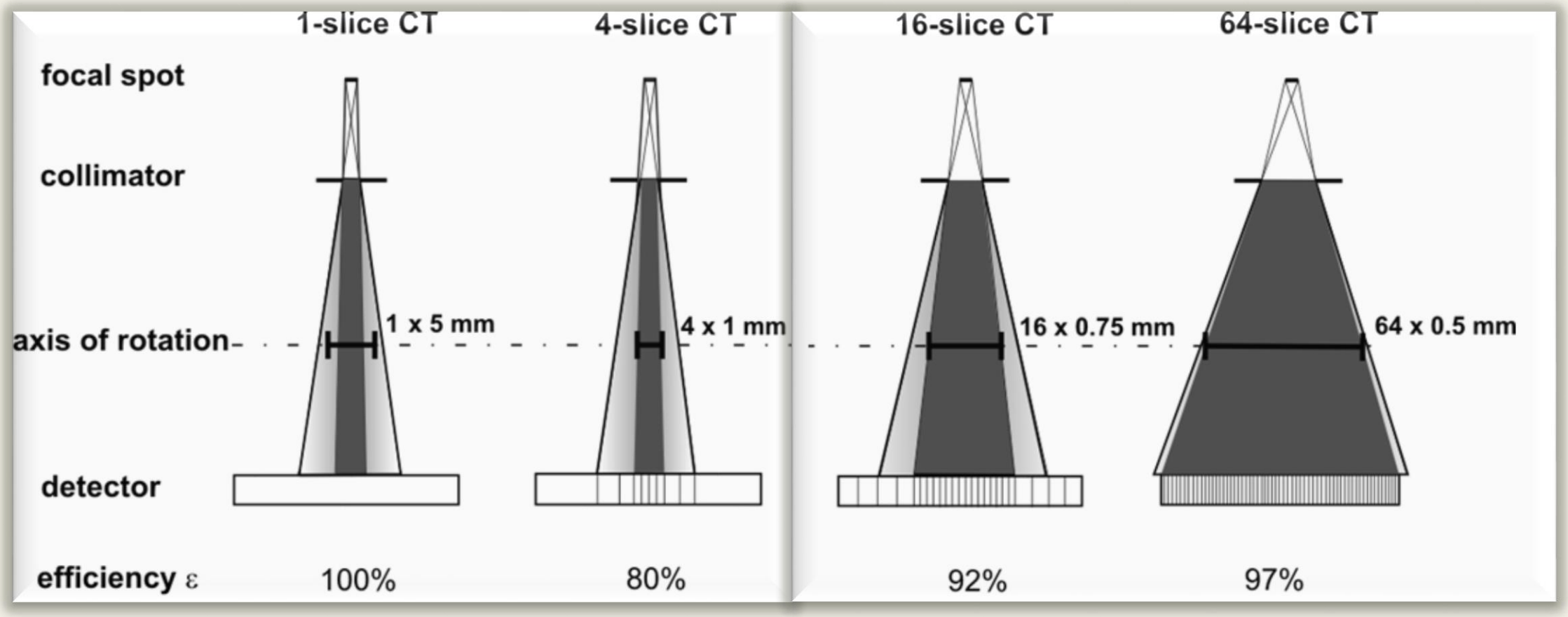
Filtrasyon





BT'de Doz Azaltımı Nasıl Sağlanabilir ?

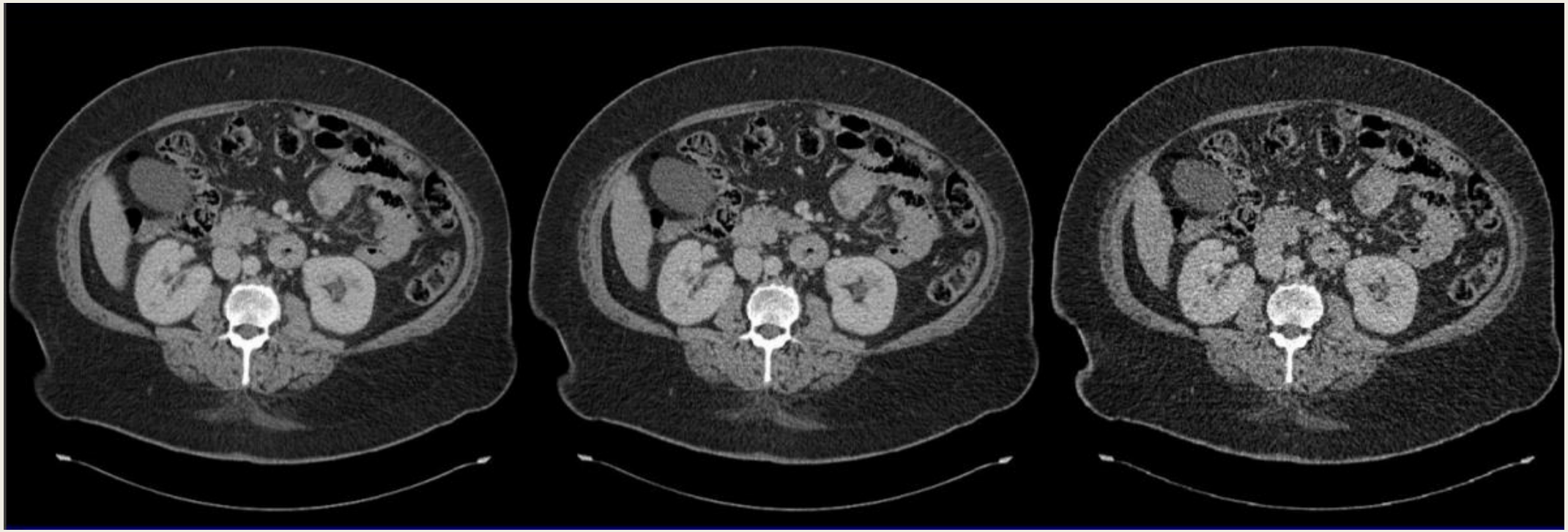
Kesit Kalınlığı



100 parçacık: 100/1 = 100 80/4 = 20 92/16 ≈ 6 97/64 ≈ 1.5

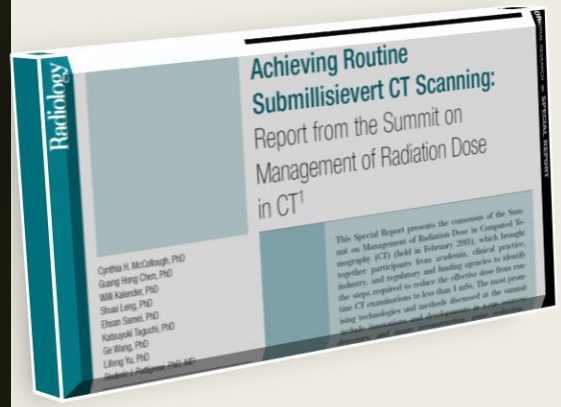
BT’de Doz Azaltımı Nasıl Sağlanabilir ?

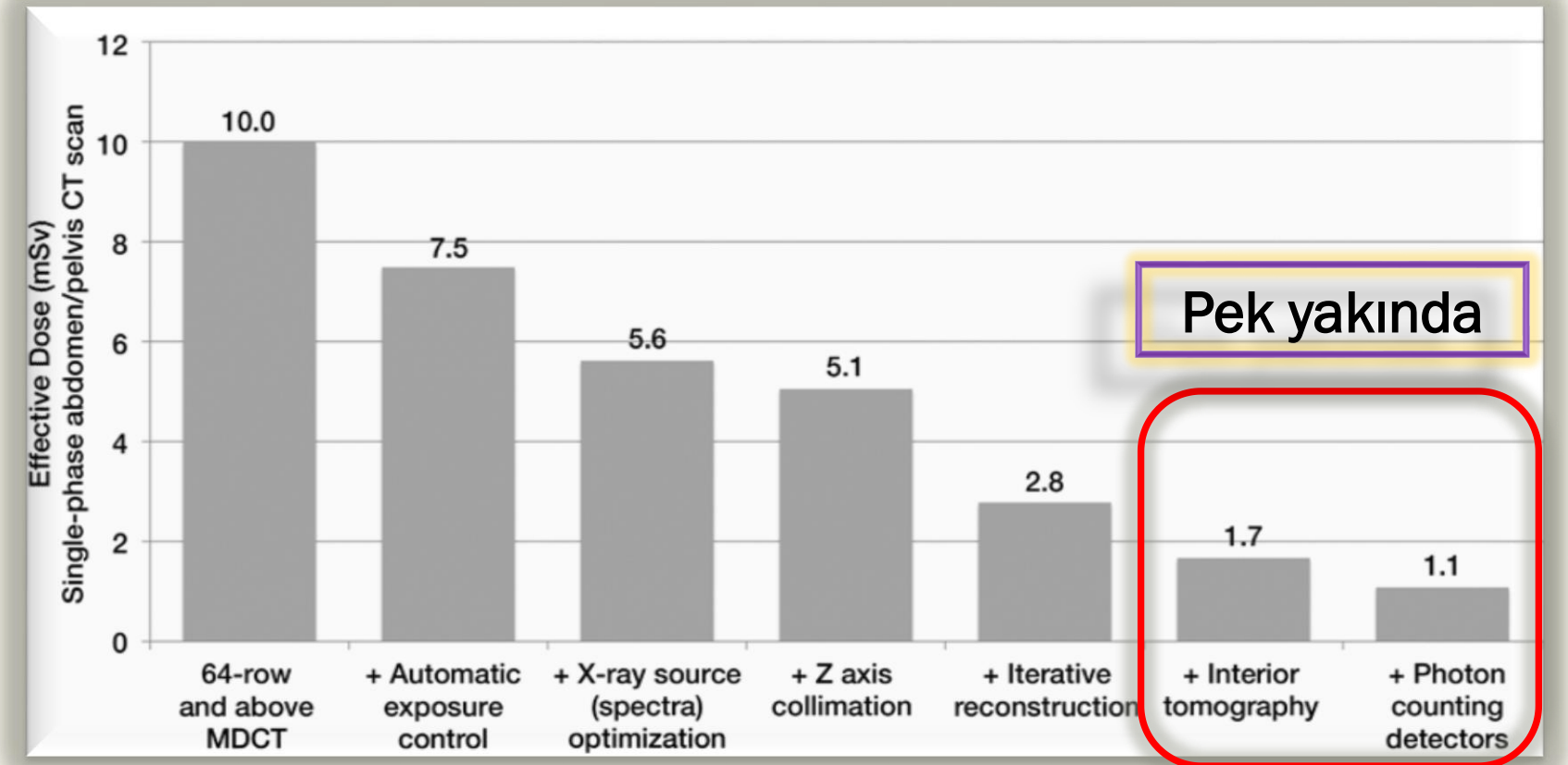
Kesit Kalınlığı



5 mm 3 mm 1 mm

BT'de Doz Azaltımı Nasıl Sağlanabilir ?



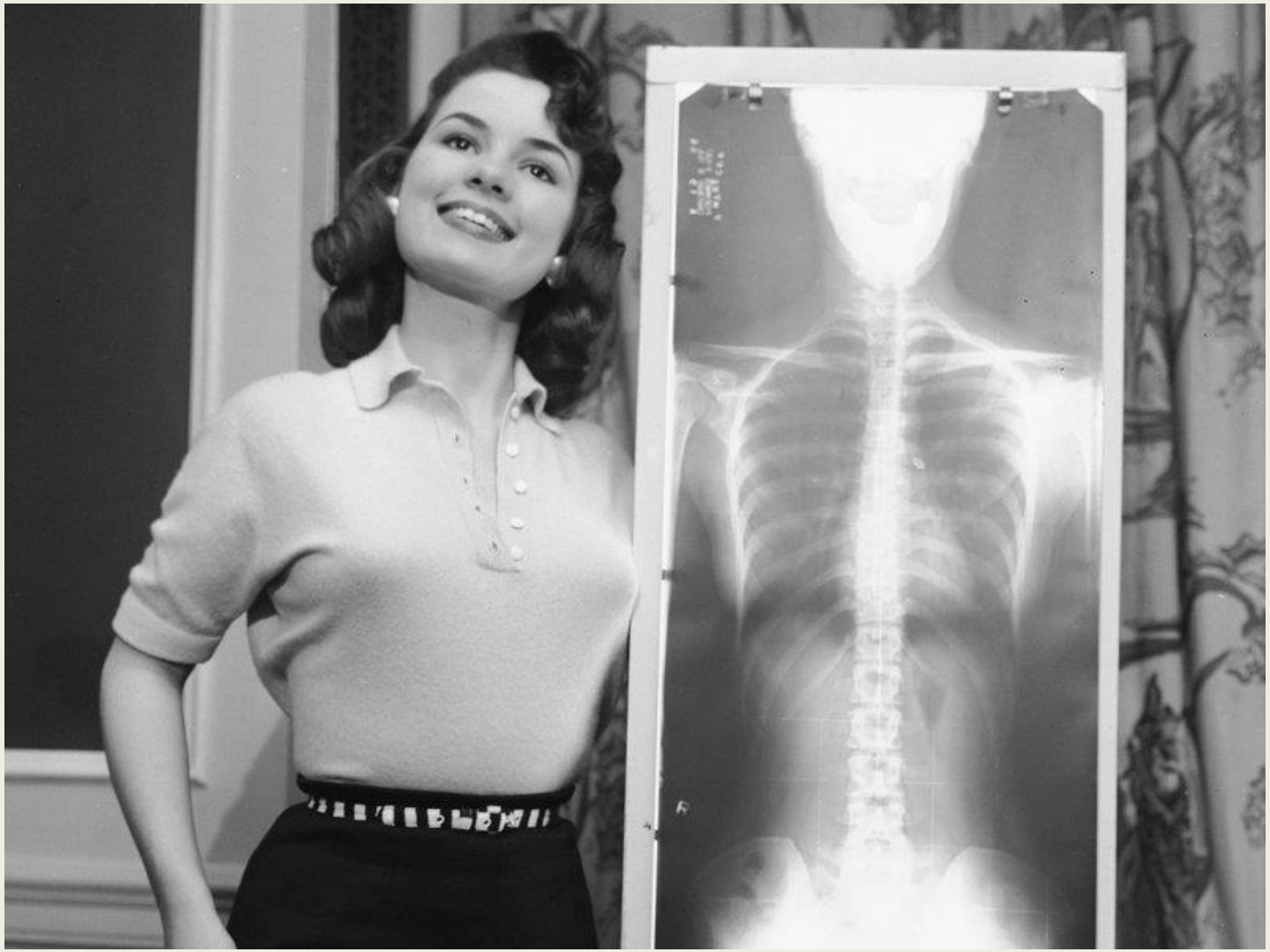


Pek yakında

+ Yapay Zeka

BT’de Doz Azaltımı Nasıl Sağlanabilir ?

Kullanıcılar



BT’de Doz Azaltımı Nasıl Sağlanabilir ?

Kullanıcılar

GEREKÇELENDİRME ?

İngiliz Sağlık Bakanlığı, sağlıklı her 50 kişiden birinin radyasyona maruz kalarak kansere yakalandığı gerekçesiyle tomografiyi yasakladı.

İngiltere'de sağlıklı kişilerin vücut tomografisi çektirmesi yasaklandı. Sağlık Bakanlığı'na göre, tomografi esnasında vücudun maruz kaldığı radyasyon, Hiroşima'da atom bombasından kurtulan kişilerdeki kadar.

İngiliz Sağlık Bakanlığı önceki akşam çok kritik bir karara imza atarak sağlıklı kişilerin vücut tomografisi çektirmesine yasak getirdi. Bu yasağa gidilmesine gerekçe olarak tomografi sırasında yayılan ve vücuda nüfuz eden radyasyon oranının çok yüksek olması gösterildi.

Tomografi çektirmek geçen yıllarda osteoporoz, kalp rahatsızlığı, damar tıkanıklığı ve diyabet gibi hastalıkları önceden tespit edebildiği için sağlık uzmanları tarafından sıklıkla tavsiye ediliyordu.

Sağlıklı bireylerin her beş yılda bir tomografi çektirmesini öneren doktorların bu tavsiyesi üzerine harekete geçen bakanlık, tüm vücudu tarayan tomografinin normal bir röntgenden 400 kat daha fazla radyasyon yaydığını tespit edince yasak kararı aldı.

Tomografiye sağlıklı giren her 50 hastadan birinin maruz kalınan radyasyon nedeniyle çekim sonrasında kansere yakalandığı belirtildi.

GEREKÇELENDİRME ?

Committee on Medical Aspects of Radiation in the Environment (COMARE)

TWELFTH REPORT

The impact of personally initiated X-ray computed tomography scanning for the health assessment of asymptomatic individuals.

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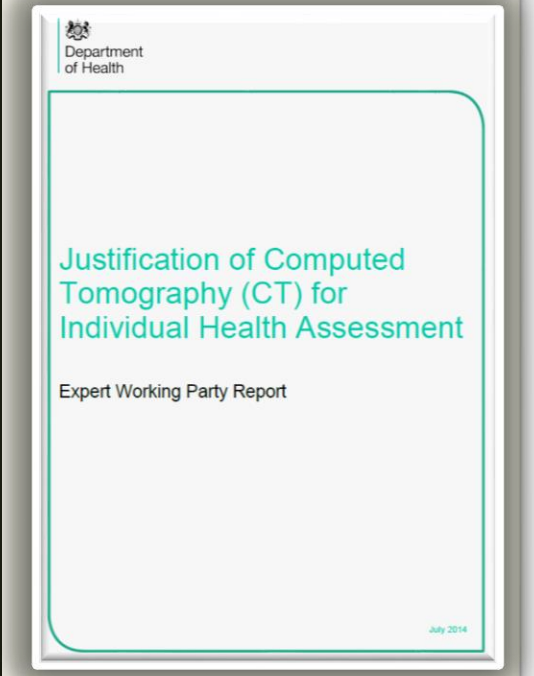
GEREKÇELENDİRME ?


Department of Health

Justification of Computed Tomography (CT) for Individual Health Assessment

Expert Working Party Report

July 2014

Recommendations:

1. IHA CT for lung cancer detection should not be offered to people under the age of 55 as they are unlikely to benefit.
2. IHA CT for lung cancer detection should not be offered to people who have never smoked, or those with a pack history of less than 20 years with no other risk factors as they are unlikely to benefit.
3. Individual risk prediction models should be used to select those patients at risk of developing lung cancer. IHA CT may be offered if the risk is equivalent to 5% in 5 years. If the risk is lower IHA CT may still be offered but the balance of risk and benefit is not known. Annual or biennial screening may be offered from age 55 to 74 but few people aged 55 to 60 will be at sufficiently high risk.
4. IHA CT should only be offered by expert clinicians (radiologists and respiratory physicians), able to explain the risks and benefits of CT for IHA.
5. Information packs on the risks and benefits of CT for IHA, detailing in lay persons' language the limitations, and the risks and benefits of IHA should be made available to individuals prior to undergoing CT scanning.

GEREKÇELENDİRME ?

TABLE 19 International comparison of annual examination frequency per 1000 population

Examination*	UK	13 European countries**			UNSCEAR
		Average	Minimum	Maximum	HCL1
Chest/ Thorax	146.7	182.7	104.7	428.1	168
Cervical spine	9.3	16.3	6.5	45.3	32
Thoracic spine	4.4	10.5	4.4	20.6	16
Lumbar spine (inc.LSJ)	14.9	33.8	14.9	59.5	31
Mammography	43.7	61.3	21.7	85.0	43
Abdomen	20.1	22.3	0.7	56.0	45
Pelvis & hip	39.0	53.7	38.2	89.9	40
Barium meal	0.3	2.0	0.0	7.1	
Barium enema	3.8	2.4	0.2	12.5	9.3
Barium follow-through	0.7	0.8	0.1	1.8	
IVU	1.4	2.4	0.1	11.4	8.5
Cardiac angiography	3.3	5.2	1.7	15.0	1.5
CT head	18.7	32.6	18.7	58.0	40
CT neck	0.8	6.9	0.8	34.4	
CT chest	4.8	18.8	4.8	32.6	24
CT spine	1.5	9.0	0.9	33.7	11
CT abdomen	4.3	23.9	3.6	44.8	30
CT pelvis	1.5	4.8	0.6	24.5	19
CT trunk	14.0	19.1	0.5	106.0	
Coronary angioplasty	1.3	2.3	1.3	5.8	0.9

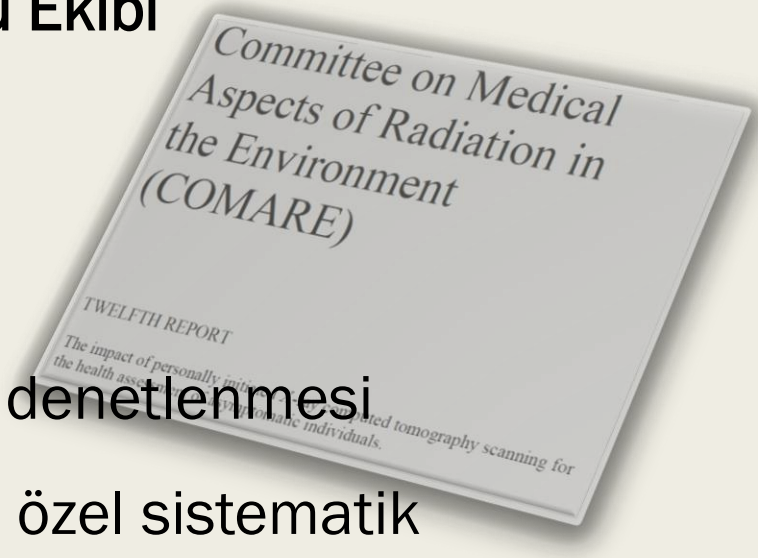
* The "European Top 20" examinations, as defined in Wall et al (2008)

** The 13 countries are Belgium, Denmark, Estonia, Finland, France, Germany, Iceland, Lithuania, Netherlands, Norway, Sweden, Switzerland, UK.

BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Ulusal ve Uluslararası Kurumlar

Radyasyondan Korunma Ekibi // Görüntü-Doz Optimizasyonu Ekibi



- Tanısal Referans Seviyeler (TRS) oluşturulması
- Ulusal DRL ile bölgesel DRL lerin karşılaştırılması
- Incelemelerin gerekçelendirme ve optimizasyon yönünden denetlenmesi
- Kısa sürede birden çok BT incelemesi istenen hastalar için özel sistematik inceleme ve alternatif önerilerin geliştirilmesi
- Gelişen cihaz teknolojisi kapsamında inceleme protokollerinin optimizasyonu ile ilgili çalışmalar
- BT ekibindeki diğer meslektaşların radyasyondan korunma eğitimini üstlenme

BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Ulusal ve Uluslararası Kurumlar

AKILCI TIBBİ GÖRÜNTÜLEME KULLANIMI

AKILCI TETKİK İSTEMİ PROSEDÜRÜ

1. Amaç

1.1. Prosedürün amacı, sağlık hizmet sunucularında, tetkik sonuçlarının klinik yararlılığını arttırmak ve gereksiz istenen tetkikleri sistemsel olarak belirleyerek tetkik yoğunluğunu azaltmaktır.

2. Kapsam

2.1. Acil ünitesi dışında ayaktan sağlık hizmet sunucularında istenen radyolojik tetkik istemlerini kapsar.

3. Tanımlar

3.1. BT: Bilgisayarlı tomografi tetkikidir.

3.2. **MR**: Manyetik rezonans görüntüleme tetkikidir.

3.3. Radyolojik Tetkik İstem Periyodu Listesi: Hastadan bir tetkikin istenmesinden sonra aynı tetkikin yeniden istenebilmesi için önerilen süreyi tanımlayan, Bakanlıkça oluşturulmuş listedir.

3.4. Tetkik İstemi Uyarı Sistemi: Belirlenen süreler içerisinde klinisyen tarafından yapılabilecek gereksiz tetkik istemini azaltmak amaçlı kullanılan uyarı sistemidir.

BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Ulusal ve Uluslararası Kurumlar

ABDOMINAL REGION	Procedure	Approximate effective radiation dose	Comparable to natural background radiation for:
	Computed Tomography (CT)–Abdomen and Pelvis	10 mSv	3 years
	Computed Tomography (CT)–Abdomen and Pelvis, repeated with and without contrast material	20 mSv	7 years
	Computed Tomography (CT)–Colonography	6 mSv	2 years
	Intravenous Pyelogram (IVP)	3 mSv	1 year
	Barium Enema (Lower GI X-ray)	8 mSv	3 years
	Upper GI Study with Barium	6 mSv	2 years

CENTRAL NERVOUS SYSTEM	Procedure	mate effective n dose	Comparable to natural background radiation for:
	Computed Tomography (CT)–Head	2 mSv	8 months
	Computed Tomography (CT)–Head, repeated with and without contrast material	4 mSv	16 months
	Computed Tomography (CT)–Spine	6 mSv	2 years

60 GÜN

CHEST	Procedure	Approximate effective radiation dose	Comparable to natural background radiation for:
	Computed Tomography (CT)–Chest	7 mSv	2 years
	Computed Tomography (CT)–Lung Cancer Screening	1.5 mSv	6 months
	Chest X-ray	0.1 mSv	10 days

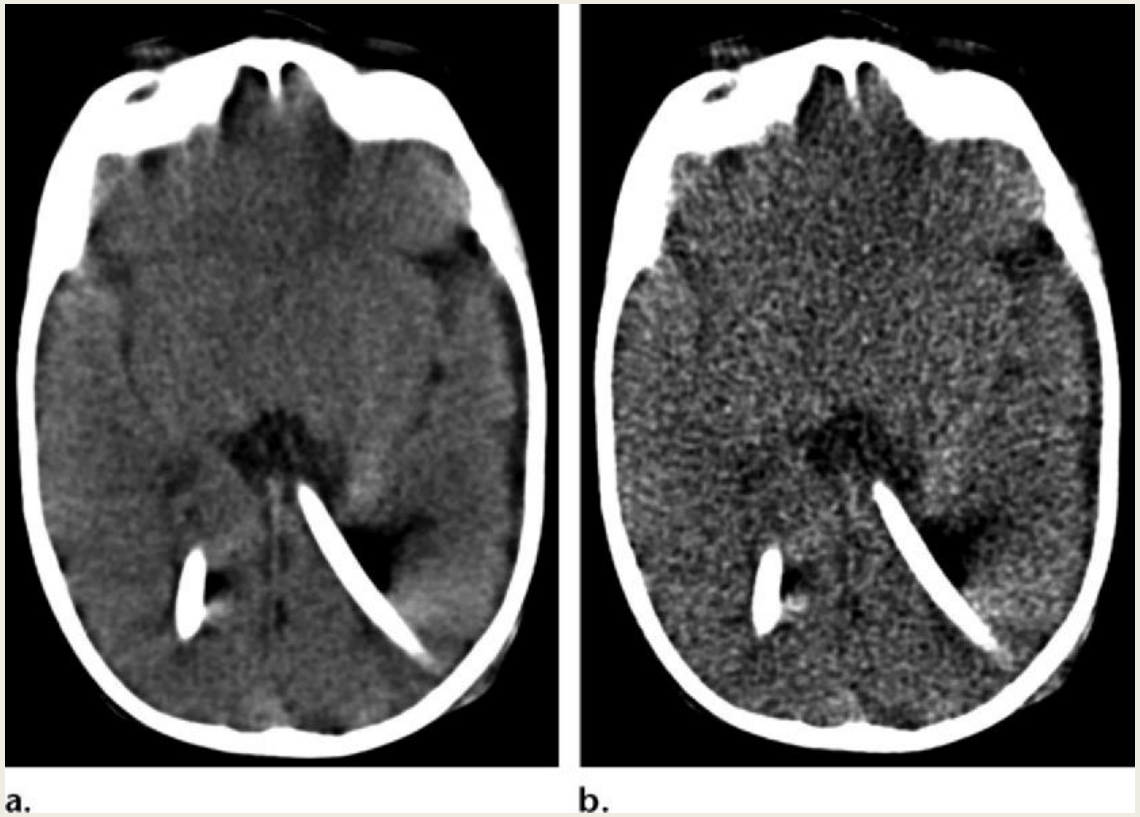
BT'de Doz Azaltımı Nasıl Sağlanabilir ?

Ulusal ve Uluslararası Kurumlar

DENTAL	Procedure	Approximate effective radiation dose	Comparable to natural background radiation for:
	Dental X-ray	0.005 mSv	1 day
MEN'S IMAGING	Procedure	ximate effective ion dose	Comparable to natural background radiation for:
	Bone Densitometry (DEXA)	0.001 mSv	3 hours

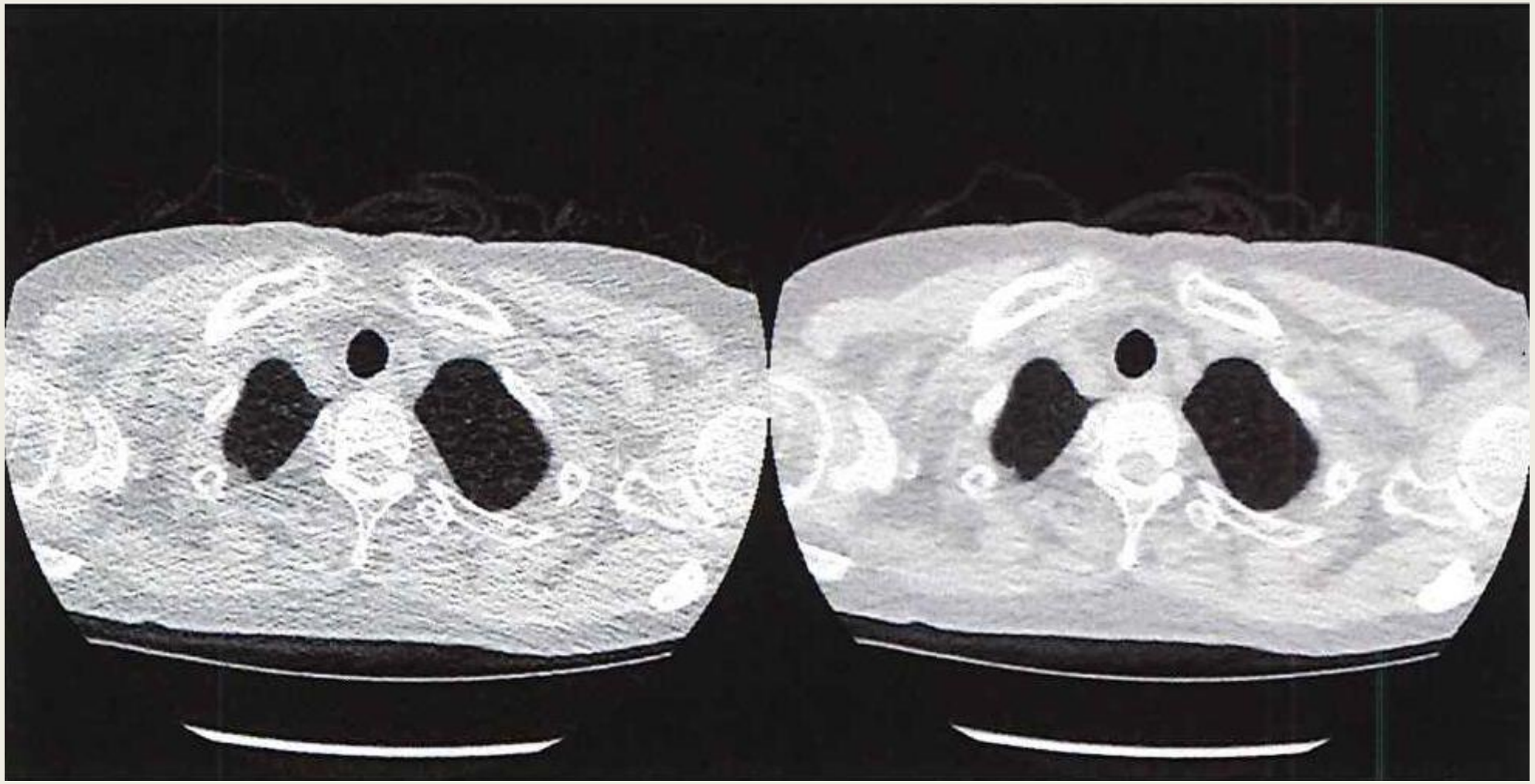
365 GÜN

Sonuç olarak..



15 aylık bebek.. Sol ventrikülün gözlenmesi için yeterli kalitede bir görüntü % 80 daha düşük dozla elde edilebiliyor..

Sonuç olarak..



TEŞEKKÜRLER

"It seemed at first a new kind of invisible light. It was clearly something new, something unrecorded. There is much to do, and I am busy, very busy.“

W. C. Roentgen