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NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 16137-2021

Replacing GB/T 16137-1995

Methods for estimation of examinee's organ doses in X-ray diagnosis

X射线诊断中受检者器官剂量的估算方法

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1 Scope

GB/T 16137-2021 is the Chinese national standard on methods for estimation of examinee's organ doses in x-ray diagnosis, in the field of environment and health protection, safety. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 21 May 2021 by the State Administration for Market Regulation; Standardization Administration of China, and has been in force since 1 December 2021. Classification: ICS 13.280, CCS C57. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This document specifies the exposure dose of the main organs (or tissues) of the subject under specific irradiation conditions in common medical X-ray diagnosis Estimation method and related parameters. This document is suitable for receiving general X-ray photography, X-ray fluoroscopy, X-ray mammography and X-ray computed tomography (CT) Of subjects.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 OrdinaryX-rayradiography Including traditional X-ray photography, digital X-ray photography (DR) and computer X-ray photography (CR) that use screen/film as the image receiver.

3.2 Incident air kerma Ka,i On the central axis of the ray beam on the surface of the subject or phantom, the measured air kerma kinetic energy generated by the incident beam.

Note. Only refers to the incident radiation to the examinee or phantom, does not include backscattered radiation.

3.3 Entrance surface airkerma Ka,e The actual measured air kerma kinetic energy on the axis of the center line of the subject or the surface position of the phantom.

Note. Including the radiation incident on the surface of the subject or phantom and its backscattered radiation.

3.4 Back-scattering factor; BSF Quantitatively characterize the scattering coefficient caused by the medium that makes the angle of the radiation or particle travel direction relative to the original direction greater than 90°.

Note. The backscattering factor is equal to the ratio of the kerma kinetic energy of the incident surface air to the kerma kinetic energy of the incident air.

3.5 Airkerma-areaproduct PKA In a plane perpendicular to the beam axis, the product of the air kerma and the area of the irradiation field.

3.6 Airkerma-lengthproduct PKL In the plane perpendicular to the beam axis, the product of the air kerma and the length of the irradiation field.

3.7 Volume CT air kerma kinetic energy index volumeCTairkermaindex CVOL The average value of the air kerma in the overall scan volume in an axial scan or spiral scan can be measured to obtain the weighted CT air ratio The ratio of the release kinetic energy index (CW) to the CT spiral factor (p).

3.8 Organ dose DT The average energy of ionizing radiation absorbed by a specific tissue or organ (T) of the human body divided by the total mass of the tissue or organ.

3.9 Average mammaryglandulardose DG The average absorbed dose of the subject's breast caused by mammography.

3.10 Effectivedose The equivalent dose of each tissue or organ of the human body is multiplied by the corresponding tissue weighting factor, and the expression relationship is. E=sum wT·HT Where. E

4.1 General X-ray photography

4.1.1 Organ dose calculation formula The organ dose is calculated according to formula (1). DT=CT·Ka,e (1) Where. DT

--- the absorbed dose of tissues or organs, in milligrays (mGy); CT

---organ dose conversion coefficient, the unit is milligray per gray (mGy/Gy); Ka,e-the kerma kinetic energy of the air incident on the body surface, in gray (Gy).

4.1.2 Obtaining the kerma kinetic energy of the air on the surface of the incident body

4.1.2.1 The actual measurement results of the kerma (Ka,

e) of the incident surface air should be used first.

4.1.2.2 If there is no actual measurement result of the air kerma of the body surface, the PKA value of the area product of the air kerma can be used to estimate according to formula (2) Calculate Ka,e. Ka,e= PKA W·L · SID FSD ·BSF (2) Where. Ka,e

--- the kerma kinetic energy of the incident surface air, in gray (Gy); PKA

---The product of air kerma kinetic energy area, in gray square centimeters (Gy cm2); W

--- the width of the irradiation field, in centimeters (cm); L

--- the length of the irradiation field, in centimeters (cm); SID

--- the distance from the focus to the receiver, in centimeters (cm); FSD

---focus distance, in centimeters (cm); BSF

---Backscattering factor (see Appendix A).

4.1.3 Organ dose conversion factor

4.1.3.1 Adult organ dose conversion factor. Tables C.1 to C.15 in Appendix C show six common body positions for adult X-ray photography. Test the dose conversion factor of each tissue or organ.

4.1.3.2 Children's organ dose conversion factor. Table C.16~Table C.30 in Appendix C show two common positions for X-ray photography of 5-year-old and The dose conversion coefficient of each tissue or organ in a 10-year-old child.

4.1.3.3 When estimating the organ dose of a particular subject, if the size and quality of the subject are similar to those listed in Appendix C, Similarly, the corresponding organ dose conversion coefficients in Table C.1~Table C.30 can be used directly. The dose of irradiation field changes to the exposed organs in the irradiation field The impact is negligible, but it has a greater impact on the exposed organs in the field. For the same posture photography, the actual FSD used is the same as in Appendix C The difference in FSD listed has relatively little effect on the dose of organs in the irradiation field.

4.2 X-ray fluoroscopy

4.2.1 The calculation of the subject's organ dose caused by X-ray fluoroscopy can refer to formula (1).

4.2.2 The method of obtaining the kerma kinetic energy of the incident surface air by X-ray fluoroscopy can refer to 4.1.2.

4.2.3 The organ dose conversion coefficients of adult men and women undergoing X-ray fluoroscopy in different positions are as follows:

a) For the organ dose conversion coefficients of adult men and women undergoing esophageal fluoroscopy, see Table D.1 to Table D.6 in Appendix D;

b) Refer to Table D.7 and Table D.8 of Appendix D for the organ dose conversion coefficients of adult men and women undergoing gastric fluoroscopy;

c) For the typical values of the organ dose conversion coefficients for adult men and women receiving cardiovascular angiography, see Appendix D, Table D.9.

4.3 Mammography

4.3.1 Organ dose calculation formula The average breast dose is calculated according to formula (4). DG=CG·Ka,i (4) Where. DG

--- average breast dose, in milligrays (mGy); CG

---The average dose conversion coefficient of different targets/filters and different proportions of glands, in milligray per milligray (mGy/mGy); Ka,i-the kerma kinetic energy of incident air, in milligray (mGy).

4.3.2 Obtaining the kerma kinetic energy of incident air

4.3.2.1 The actual measurement results of the kerma (Ka,

i) of incident air without the subject or phantom should be used first.

4.3.2.2 If the measured data of the kerma (Ka,