



Justificación y Optimización en Medicina Nuclear Pediátrica



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- ▶ Justificación mediante validación de las peticiones
- ▶ Optimización de la dosimetría en MN, mediante ajuste de la mínima dosis del radiofármaco.
- ▶ Optimización de la dosimetría en imagen híbrida, mediante disminución de la dosimetría del CT.
- ▶ Optimización de la imagen, para obtener la mejor calidad de imagen posible con la exploración.



MNP: *Justificación y optimización*

JUSTIFICACIÓN

→ **VALIDACIÓN** de la petición

OPTIMIZACIÓN de la DOSIMETRÍA

Imagen de MN

→ **MINIMA DOSIS** de radiofármaco

Imagen híbrida

→ Disminuir la **DOSIMETRIA DEL CT**

OPTIMIZACIÓN de la IMAGEN

→ Obtener la **IMAGEN CON LA MEJOR CALIDAD POSIBLE**



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DOSIS
MÍNIMA

BUENA
CALIDAD
IMAGEN

VALIDACIÓN DE LA PETICIÓN

ES OBLIGATORIA →

MBUR

MAKE THE BEST USE OF RADIOLOGY



MBUR

Make The Best Use of Radiology

ES OBLIGATORIO

- REVISAR LA PETICIÓN PARA REALIZAR LA EXPLORACIÓN CON RADIACIONES IONIZANTES
- REALIZAR LA EXPLORACIÓN CON MENOR DOSIMETRÍA
- CON MEJOR COSTE-BENEFICIO

- Documento con recomendaciones basadas en
(1^{stly} published by Royal College of Radiologists)
- Revisiones:
 - ✓ Sociedades Científicas
 - ✓ Paediatric Committee de la EANM
- Algunos países la han incorporado dentro del marco legal
(radiaciones ionizantes)



MBUR

Make
The
Best
Use
of
Radiology

VALIDACIÓN DE LA PETICIÓN

- Revisar la INDICACIÓN de la prueba:
 - +++ en caso de gammagrafías con alta dosimetría
 - Gammagrafía con leucocitos marcados
 - ^{67}Ga lio
- Explicaciones y colaboración con los pediatras
- Participación en comités clínicos:
Oncología, Nefrourología, Endocrinología, Ortopedia, enfermedades infecciosas e inmunes, Reumatología....
- Coste-beneficio



MBUR

Ejemplos en Pediatría

SÍNTOMAS CLÍNICOS	TÉCNICA	RECOMENDACION
HN Neonatal Dilatación postnatal persistente	Renograma MAG3	Indicado
RVU Persistente	Cistogammagrafía directa o indirecta	No por rutina
UTI	Gammagrafía renal DMSA	Indicado



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→ Disminuir la **DOSIMETRIA DEL CT**

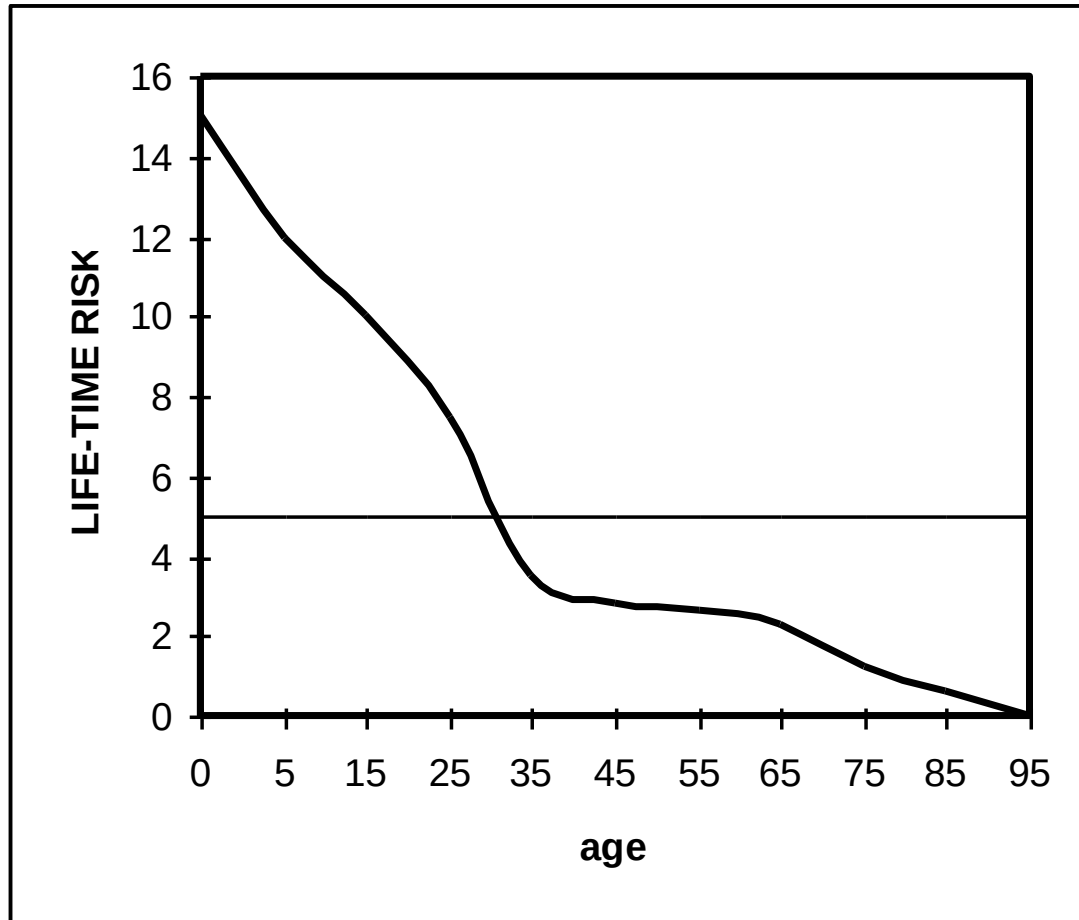
OPTIMIZACIÓN de la IMAGEN

→ Obtener la **IMAGEN CON LA MEJOR CALIDAD POSIBLE**



DOSIMETRIA

Riesgo a lo largo de la vida y edad a la exposición



La protección contra la radiación es un tema importante, en especial en los niños

Los niños son más susceptibles a las neoplasias malignas relacionas con la radiación que los adultos

Esta sensibilidad es mayor a menor edad, en lactantes y niños pequeños

Los niños tienen una esperanza de vida más larga para presentar los efectos tardíos de la radiación

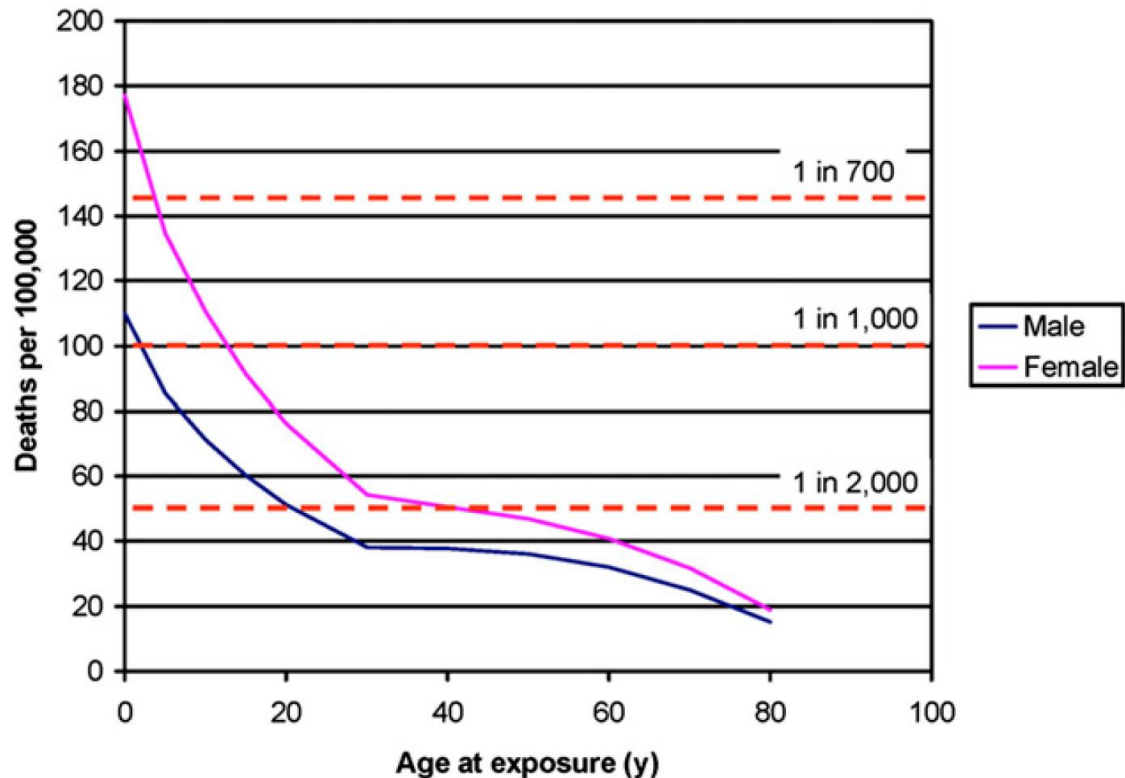
Las neoplasias malignas radiogénicas más frecuentes en niños y adultos jóvenes son la leucemia, tumores cerebrales y cancer de tiroides

Fahey FH, Bom HH, Chiti A, Choi YY, Huang G, Lassmann M, Laurin N, Mut F, Nuñez-Miller R, O'Keeffe D, Pradhan P, Scott AM, Song S, Soni N, Uchiyama M, Vargas L. Standardization of Administered Activities in Pediatric Nuclear Medicine: A Report of the First Nuclear Medicine Global Initiative Project, Part 2-Current Standards and the Path Toward Global Standardization. J Nucl Med. 2016 Jul;57(7):148-57.

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DOSIMETRÍA

Muertes por 100.000 y edad a la exposición



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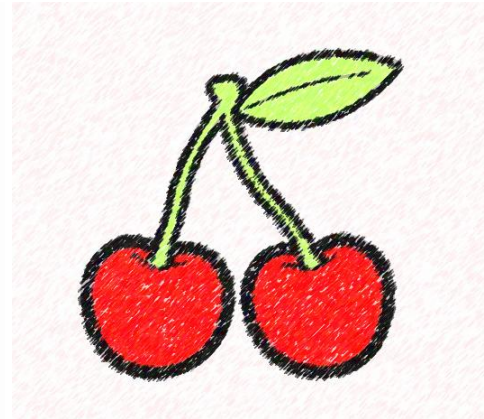
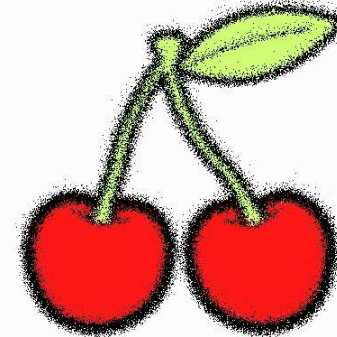
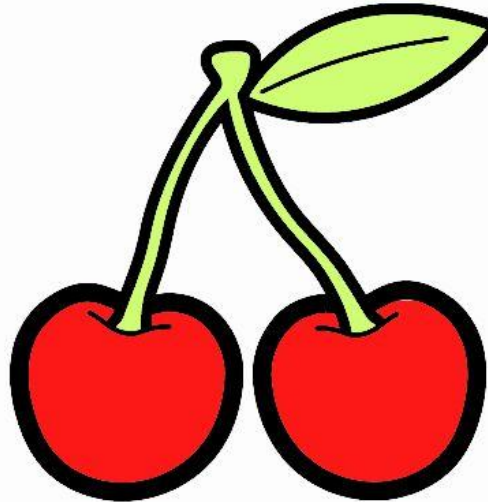
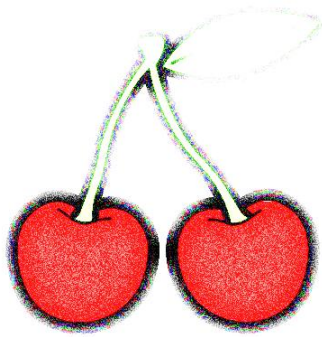
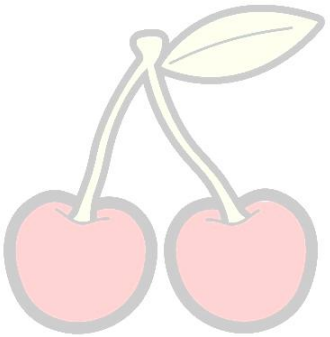
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DOSIS MÍNIMA - DOSIMETRÍA

Debemos administrar la **Dosis Mínima** que
nos permita
Obtener la **MEJOR CALIDAD** de la imagen



DOSIS MÍNIMA - DOSIMETRÍA

→ Necesitamos administrar la **DOSIS MÍNIMA**

→ Necesitamos una BUENA CALIDAD de la IMAGEN
la **MEJOR CALIDAD POSIBLE** de la **IMAGEN**

Dosis: individualizadas

Calculo se puede basar en:

Peso

Altura

Superficie corporal



DOSIS

dosis mínima óptima

DOSIS MÍNIMA ÓPTIMA

Nos permite:

- obtener la mejor calidad posible de imagen
- administrar la menor dosimetría
- Neonatos: Dosis mínima

Último update Agosto 2016

ALARA

Jacobs F, Thierens H, Piepsz A, Bacher K, Van de Wiele C, Ham H, Dierckx RA. Optimized tracer-dependent dosage cards to obtain weightindependent effective doses. Eur J Nucl Med Mol Imaging. 2005 May; 32(5):581-8.

M. Lassmann, S.T.Treves. Pediatric Radiopharmaceutical Administration: Harmonization of the 2007 EANM Paediatric Dosage Card (Version 1.5.2008) and the 2010 North America Consensus guideline, Eur J Nucl Med Mol Imaging. 2014, DOI: 10.1007/s00259-014-2731-9.

Lassmann M, Biassoni L, Monsieurs M, Franzius C; EANM Dosimetry and Paediatrics Committees. The new EANM paediatric dosage card: additional notes with respect to F-18. Eur J Nucl Med Mol Imaging. 2008 Sep;35(9):1666-8. doi: 10.1007/s00259-008-0799-9. Epub 2008 Jun 24. Erratum in: Eur J Nucl Med Mol Imaging. 2008 Nov;35(11):2141



Dosage Card (Version 5.7.2016)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33

$$A[MBq]_{\text{Administered}} = \text{BaselineActivity} \times \text{Multiple}$$

- For a calculation of the administered activity, the baseline activity value has to be multiplied by the multiples given above for the recommended radiopharmaceutical class (see reverse).
- If the resulting activity is smaller than the minimum recommended activity, the minimum activity should be administered.
- The national diagnostic reference levels should not be exceeded!

Examples:

- ^{18}F FDP-PET Brain, 50 kg: activity to be administered [MBq] = 14.0×10.71 [MBq] = 150 MBq
- ^{123}I mIBG, 3 kg: activity to be administered [MBq] = 28.0×1 [MBq] = 28 MBq < 37 MBq (Minimum Recommended Activity) → activity to be administered: 37 MBq

This card is based upon the publication by Jacobs F, Thierens H, Piepsz A, Bacher K, Van de Wiele C, Ham H, Dierckx RA. Optimized tracer-dependent dosage cards to obtain weight-independent effective doses. Eur J Nucl Med Mol Imaging. 2005 May; 32(5):581-8.

This card summarizes the views of the Paediatric and Dosimetry Committees of the EANM and reflects recommendations for which the EANM cannot be held responsible. The dosage recommendations should be taken in context of „good practice“ of nuclear medicine and do not substitute for national and international legal or regulatory provisions.



Android App



iPhone App

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Recommended Amounts in MBq

Radiopharmaceutical	Class	Baseline Activity (for calculation purposes only)	Minimum Recommended Activity ¹
		MBq	MBq
^{123}I (Thyroid)	C	0.6	3
^{123}I Amphetamine (Brain)	B	13.0	18
^{123}I HIPURAN (Abnormal renal function)	B	5.3	10
^{123}I HIPURAN (Normal renal function)	A	12.8	10
^{123}I mIBG	B	28.0	37
^{131}I mIBG	B	5.6	35
^{18}F FDG-PET torso	B	25.9	26
^{18}F FDG-PET brain	B	14.0	14
^{18}F Sodium fluoride	B	10.5	14
^{67}Ga Citrate	B	5.6	10
^{68}Ga -labelled peptides	B	12.8	14
$^{99\text{m}}\text{Tc}$ ALBUMIN (Cardiac)	B	56.0	80
$^{99\text{m}}\text{Tc}$ COLLOID (Gastric Reflux)	B	2.8	10
$^{99\text{m}}\text{Tc}$ COLLOID (Liver/Spleen)	B	5.6	15
$^{99\text{m}}\text{Tc}$ COLLOID (Marrow)	B	21.0	20
$^{99\text{m}}\text{Tc}$ DMSA	B	6.8	18.5
$^{99\text{m}}\text{Tc}$ DTPA (Abnormal renal function)	B	14.0	20
$^{99\text{m}}\text{Tc}$ DTPA (Normal renal function)	A	34.0	20
$^{99\text{m}}\text{Tc}$ ECD	B	51.8	100
$^{99\text{m}}\text{Tc}$ HMPAO (Brain)	B	51.8	100
$^{99\text{m}}\text{Tc}$ HMPAO (WBC)	B	35.0	40
$^{99\text{m}}\text{Tc}$ IDA (Biliary)	B	10.5	20
$^{99\text{m}}\text{Tc}$ MAA / Microspheres	B	5.6	10
$^{99\text{m}}\text{Tc}$ MAG3	A	11.9	15
$^{99\text{m}}\text{Tc}$ MDP	B	35.0	40
$^{99\text{m}}\text{Tc}$ Pertechinate (Cystography)	B	1.4	20
$^{99\text{m}}\text{Tc}$ Pertechinate (Ectopic Gastric Mucosa)	B	10.5	20
$^{99\text{m}}\text{Tc}$ Pertechinate (Cardiac First Pass)	B	35.0	80
$^{99\text{m}}\text{Tc}$ Pertechinate (Thyroid)	B	5.6	10
$^{99\text{m}}\text{Tc}$ RBC (Blood Pool)	B	56.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin (Cancer seeking agent)	B	63.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin ² (Cardiac rest scan 2-day protocol min)	B	42.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin ² (Cardiac rest scan 2-day protocol max)	B	63.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin ² (Cardiac stress scan 2-day protocol min)	B	42.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin ² (Cardiac stress scan 2-day protocol max)	B	63.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin ² (Cardiac rest scan 1-day protocol)	B	28.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin ² (Cardiac stress scan 1-day protocol)	B	84.0	80
$^{99\text{m}}\text{Tc}$ Spleen (Denatured RBC)	B	2.8	20
^{99}Tc TECHNEGAS (Lung ventilation) ³	B	49.0	100

¹ The minimum recommended activities are calculated for commonly used gamma cameras or positron emission tomographs. Lower activities could be administered when using systems with higher counting efficiency.

² The minimum and maximum values correspond to the recommended administered activities in the EANM/ESC procedural guidelines (Hesse B, Tagil K, Cuocolo A, et al). EANM/ESC procedural guidelines for myocardial perfusion imaging in nuclear Cardiology. Eur J Nucl Med Mol Imaging. 2005 Jul;32(7):855-97.

³ This is the activity load needed to prepare the Technegas device. The amount of inhaled activity will be lower.

<https://www.eanm.org/publications/dosage-card/>



CÁLCULO DE LA DOSIS

3 opciones

1. DOSAGE CARD

Dosage Card (Version 5.7.2016)									
Multiple of Baseline Activity									
Age	Class	Class	Class	Class	Class	Class	Class	Class	Class
Age	A	B	C	A	B	C	A	B	C
1	1	1	1	1	1	1	1	1	1
2	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	1.47	1.71	2.06	1.47	1.71	2.06	1.47	1.71	2.06
4	1.75	2.14	2.58	1.75	2.14	2.58	1.75	2.14	2.58
5	1.96	2.71	3.47	1.96	2.71	3.47	1.96	2.71	3.47
6	2.18	3.14	4.47	2.18	3.14	4.47	2.18	3.14	4.47
7	2.39	3.57	5.47	2.39	3.57	5.47	2.39	3.57	5.47
8	2.55	4.00	6.38	2.55	4.00	6.38	2.55	4.00	6.38
9	2.71	4.43	7.38	2.71	4.43	7.38	2.71	4.43	7.38
10	2.88	4.86	8.38	2.88	4.86	8.38	2.88	4.86	8.38
11	3.06	5.29	9.38	3.06	5.29	9.38	3.06	5.29	9.38
12	3.18	5.71	10.38	3.18	5.71	10.38	3.18	5.71	10.38
13	3.31	6.14	11.38	3.31	6.14	11.38	3.31	6.14	11.38
14	3.47	6.57	12.38	3.47	6.57	12.38	3.47	6.57	12.38
15	3.61	6.99	13.38	3.61	6.99	13.38	3.61	6.99	13.38
16	3.75	7.42	14.38	3.75	7.42	14.38	3.75	7.42	14.38
17	3.90	7.85	15.38	3.90	7.85	15.38	3.90	7.85	15.38
18	4.05	8.28	16.38	4.05	8.28	16.38	4.05	8.28	16.38
19	4.20	8.71	17.38	4.20	8.71	17.38	4.20	8.71	17.38
20	4.35	9.14	18.38	4.35	9.14	18.38	4.35	9.14	18.38
21	4.50	9.57	19.38	4.50	9.57	19.38	4.50	9.57	19.38
22	4.65	10.00	20.38	4.65	10.00	20.38	4.65	10.00	20.38
23	4.80	10.43	21.38	4.80	10.43	21.38	4.80	10.43	21.38
24	4.95	10.86	22.38	4.95	10.86	22.38	4.95	10.86	22.38
25	5.10	11.29	23.38	5.10	11.29	23.38	5.10	11.29	23.38
26	5.25	11.72	24.38	5.25	11.72	24.38	5.25	11.72	24.38
27	5.40	12.15	25.38	5.40	12.15	25.38	5.40	12.15	25.38
28	5.55	12.58	26.38	5.55	12.58	26.38	5.55	12.58	26.38
29	5.70	13.01	27.38	5.70	13.01	27.38	5.70	13.01	27.38
30	5.85	13.44	28.38	5.85	13.44	28.38	5.85	13.44	28.38
31	6.00	13.87	29.38	6.00	13.87	29.38	6.00	13.87	29.38
32	6.15	14.30	30.38	6.15	14.30	30.38	6.15	14.30	30.38
33	6.30	14.73	31.38	6.30	14.73	31.38	6.30	14.73	31.38
34	6.45	15.16	32.38	6.45	15.16	32.38	6.45	15.16	32.38
35	6.60	15.59	33.38	6.60	15.59	33.38	6.60	15.59	33.38
36	6.75	16.02	34.38	6.75	16.02	34.38	6.75	16.02	34.38
37	6.90	16.45	35.38	6.90	16.45	35.38	6.90	16.45	35.38
38	7.05	16.88	36.38	7.05	16.88	36.38	7.05	16.88	36.38
39	7.20	17.31	37.38	7.20	17.31	37.38	7.20	17.31	37.38
40	7.35	17.74	38.38	7.35	17.74	38.38	7.35	17.74	38.38
41	7.50	18.17	39.38	7.50	18.17	39.38	7.50	18.17	39.38
42	7.65	18.60	40.38	7.65	18.60	40.38	7.65	18.60	40.38
43	7.80	19.03	41.38	7.80	19.03	41.38	7.80	19.03	41.38
44	7.95	19.46	42.38	7.95	19.46	42.38	7.95	19.46	42.38
45	8.10	19.89	43.38	8.10	19.89	43.38	8.10	19.89	43.38
46	8.25	20.32	44.38	8.25	20.32	44.38	8.25	20.32	44.38
47	8.40	20.75	45.38	8.40	20.75	45.38	8.40	20.75	45.38
48	8.55	21.18	46.38	8.55	21.18	46.38	8.55	21.18	46.38
49	8.70	21.61	47.38	8.70	21.61	47.38	8.70	21.61	47.38
50	8.85	22.04	48.38	8.85	22.04	48.38	8.85	22.04	48.38
51	9.00	22.47	49.38	9.00	22.47	49.38	9.00	22.47	49.38
52	9.15	22.90	50.38	9.15	22.90	50.38	9.15	22.90	50.38
53	9.30	23.33	51.38	9.30	23.33	51.38	9.30	23.33	51.38
54	9.45	23.76	52.38	9.45	23.76	52.38	9.45	23.76	52.38
55	9.60	24.19	53.38	9.60	24.19	53.38	9.60	24.19	53.38
56	9.75	24.62	54.38	9.75	24.62	54.38	9.75	24.62	54.38
57	9.90	25.05	55.38	9.90	25.05	55.38	9.90	25.05	55.38
58	10.05	25.48	56.38	10.05	25.48	56.38	10.05	25.48	56.38
59	10.20	25.91	57.38	10.20	25.91	57.38	10.20	25.91	57.38
60	10.35	26.34	58.38	10.35	26.34	58.38	10.35	26.34	58.38
61	10.50	26.77	59.38	10.50	26.77	59.38	10.50	26.77	59.38
62	10.65	27.20	60.38	10.65	27.20	60.38	10.65	27.20	60.38
63	10.80	27.63	61.38	10.80	27.63	61.38	10.80	27.63	61.38
64	10.95	28.06	62.38	10.95	28.06	62.38	10.95	28.06	62.38
65	11.10	28.49	63.38	11.10	28.49	63.38	11.10	28.49	63.38
66	11.25	28.92	64.38	11.25	28.92	64.38	11.25	28.92	64.38
67	11.40	29.35	65.38	11.40	29.35	65.38	11.40	29.35	65.38
68	11.55	29.78	66.38	11.55	29.78	66.38	11.55	29.78	66.38
69	11.70	30.21	67.38	11.70	30.21	67.38	11.70	30.21	67.38
70	11.85	30.64	68.38	11.85	30.64	68.38	11.85	30.64	68.38
71	12.00	31.07	69.38	12.00	31.07	69.38	12.00	31.07	69.38
72	12.15	31.50	70.38	12.15	31.50	70.38	12.15	31.50	70.38
73	12.30	31.93	71.38	12.30	31.93	71.38	12.30	31.93	71.38
74	12.45	32.36	72.38	12.45	32.36	72.38	12.45	32.36	72.38
75	12.60	32.79	73.38	12.60	32.79	73.38	12.60	32.79	73.38
76	12.75	33.22	74.38	12.75	33.22	74.38	12.75	33.22	74.38
77	12.90	33.65	75.38	12.90	33.65	75.38	12.90	33.65	75.38
78	13.05	34.08	76.38	13.05	34.08	76.38	13.05	34.08	76.38
79	13.20	34.51	77.38	13.20	34.51	77.38	13.20	34.51	77.38
80	13.35	34.94	78.38	13.35	34.94	78.38	13.35	34.94	78.38
81	13.50	35.37	79.38	13.50	35.37	79.38	13.50	35.37	79.38
82	13.65	35.80	80.38	13.65	35.80	80.38	13.65	35.80	80.38
83	13.80	36.23	81.38	13.80	36.23	81.38	13.80	36.23	81.38
84	13.95	36.66	82.38	13.95	36.66	82.38	13.95	36.66	82.38
85	14.10	37.09	83.38	14.10	37.09	83.38	14.10	37.09	83.38
86	14.25	37.52	84.38	14.25	37.52	84.38	14.25	37.52	84.38
87	14.40	37.95	85.38	14.40	37.95	85.38	14.40	37.95	85.38
88	14.55	38.38	86.38	14.55	38.38	86.38	14.55	38.38	86.38
89	14.70	38.81	87.38	14.70	38.81	87.38	14.70	38.81	87.38
90	14.85	39.24	88.38	14.85	39.24	88.38	14.85	39.24	88.38
91	15.00	39.67	89.38	15.00	39.67	89.38	15.00	39.67	89.38
92	15.15	40.10	90.38	15.15	40.10	90.38	15.15	40.10	90.38
93	15.30	40.53	91.38	15.30	40.53	91.38	15.30	40.53	91.38
94	15.45	40.96	92.38	15.45	40.96	92.38	15.45	40.96	92.38
95	15.60	41.39	93.38	15.60	41.39	93.38	15.60	41.39	93.38
96	15.75	41.82	94.38	15.75	41.82	94.38	15.75	41.82	94.38
97	15.90	42.25	95.38	15.90	42.25	95.38	15.90	42.25	95.38
98	16.05	42.68	96.38	16.05	42.68	96.38	16.05	42.68	96.38
99	16.20	43.11	97.38	16.20	43.11	97.38	16.20	43.11	97.38
100	16.35	43.54	98.38	16.35	43.54	98.38	16.35	43.54	98.38
101	16.50	43.97	99.38	16.50	43.97	99.38	16.50	43.97	99.38
102	16.65	44.40	100.38	16.65	44.40	100.38	16.65	44.40	100.38
103	16.80	44.83	101.38	16.80	44.83	101.38	16.80	44.83	101.38
104	16.95	45.26	102.38	16.95	45.26	102.38	16.95	45.26	102.38
105	17.10	45.69	103.38	17.10	45.69	103.38	17.10	45.69	103.38
106	17.25	46.12	104.38	17.25	46.12	104.38	17.25	46.12	104.38
107	17.40	46.55	105.38	17.40	46.55	105.38	17.40	46.55	105.38
108	17.55	46.98	106.38	17.55	46.98	106.38	17.55	46.98	106.38
109	17.70	47.41	107.38	17.70	47.41	107.38	17.70	47.41	107.38
110	17.85	47.84	108.38	17.85	47.84	108.38	17.85	47.84	108.38
111	18.00	48.27	109.38	18.00	48.27	109.38	18.00	48.27	109.38
112	18.15	48.70	110.38	18.15	48.70	110.38	18.15	48.70	110.38
113	18.30	49.13	111.38	18.30	49.13	111.38	18.30	49.13	111.38
114	18.45	49.56	112.38	18.45	49.56	112.38	18.45	49.56	112.38
115	18.60	49.99	113.38	18.60	49.99	113.38	18.60	49.99	113.38
116	18.75	50.42	114.38	18.75	50.42	114.38	18.75	50.42	114.38
117	18.90	50.85	115.38	18.90	50.85	115.38	18.90	50.85	115.38
118	19.05	51.28	116.38	19.05	51.28	116.38	19.05	51.28	116.38
119	19.20	51.71	117.38	19.20	51.71	117.38	19.20	51.71	117.38
120	19.35	52.14	118.38	19.35	52.14	118.38	19.35	52.14	118.38
121	19.50	52.57	119.38	19.5					

CÁLCULO DE LA DOSIS

3 opciones

1. DOSAGE CARD

Dosage Card (Version 5.7.2016)									
Multiple of Baseline Activity									
Weight	Class	Class	Class	Class	Class	Class	Class	Class	Class
kg	A	B	C	A	B	C	A	B	C
1	1	1	1	1	1	1	1	1	1
2	1.12	1.14	1.15	1.17	1.19	1.20	1.22	1.24	1.25
3	1.47	1.71	2.06	2.38	2.79	3.20	3.61	4.02	4.43
4	1.75	2.14	2.58	3.06	3.58	4.10	4.62	5.14	5.66
5	1.96	2.71	3.47	4.29	5.20	6.10	7.00	7.91	8.82
6	2.18	3.14	4.47	5.81	7.14	8.47	9.80	11.13	12.46
7	2.39	3.57	5.47	7.41	9.14	10.87	12.60	14.33	16.06
8	2.59	4.00	6.18	8.46	10.40	12.66	14.92	17.18	19.44
9	2.77	4.43	6.78	9.24	11.36	13.92	16.18	18.44	21.70
10	2.95	4.86	7.37	10.01	12.31	15.17	17.43	19.69	23.96
11	3.12	5.29	7.95	10.78	13.26	16.42	18.68	20.94	26.22
12	3.29	5.71	8.54	11.54	14.20	17.67	19.93	22.19	28.48
13	3.45	6.14	9.13	12.30	15.14	18.92	21.18	23.44	30.74
14	3.61	6.57	9.72	13.06	16.08	20.17	22.43	24.69	33.00
15	3.77	6.99	10.31	13.82	17.02	21.42	23.68	25.94	35.26
16	3.93	7.42	10.90	14.58	17.96	22.67	24.93	27.19	37.52
17	4.08	7.84	11.49	15.34	18.90	23.92	26.18	28.44	39.78
18	4.24	8.27	12.08	16.10	19.84	25.17	27.43	29.69	42.04
19	4.39	8.69	12.67	16.86	20.78	26.42	28.68	30.94	44.30
20	4.54	9.12	13.26	17.62	21.72	27.67	29.93	32.19	46.56
21	4.69	9.54	13.85	18.38	22.66	28.92	31.18	33.44	48.82
22	4.84	9.97	14.44	19.14	23.60	30.17	32.43	34.69	51.08
23	4.99	10.39	15.03	19.90	24.54	31.42	33.68	35.94	53.34
24	5.14	10.82	15.62	20.66	25.48	32.67	34.93	37.19	55.60
25	5.29	11.24	16.21	21.42	26.42	33.92	36.18	38.44	57.86
26	5.44	11.67	16.80	22.18	27.36	35.17	37.43	39.69	60.12
27	5.59	12.09	17.39	22.94	28.30	36.42	38.68	40.94	62.38
28	5.74	12.52	17.98	23.70	29.24	37.67	39.93	42.19	64.64
29	5.89	12.94	18.57	24.46	30.18	38.92	41.18	43.44	66.90
30	6.04	13.37	19.16	25.22	31.12	40.17	42.43	44.69	69.16
31	6.19	13.79	19.75	25.98	32.06	41.42	43.68	45.94	71.42
32	6.34	14.22	20.34	26.74	33.00	42.67	44.93	47.19	73.68
33	6.49	14.64	20.93	27.50	33.94	43.92	46.18	48.44	75.94
34	6.64	15.07	21.52	28.26	34.88	45.17	47.43	49.69	78.20
35	6.79	15.49	22.11	29.02	35.82	46.42	48.68	50.94	80.46
36	6.94	15.92	22.70	29.78	36.76	47.67	49.93	52.19	82.72
37	7.09	16.34	23.29	30.54	37.70	48.92	51.18	53.44	84.98
38	7.24	16.77	23.88	31.30	38.64	50.17	52.43	54.69	87.24
39	7.39	17.19	24.47	32.06	39.58	51.42	53.68	55.94	89.50
40	7.54	17.62	25.06	32.82	40.52	52.67	54.93	57.19	91.76
41	7.69	18.04	25.65	33.58	41.46	53.92	56.18	58.44	94.02
42	7.84	18.47	26.24	34.34	42.40	55.17	57.43	59.69	96.28
43	7.99	18.89	26.83	35.10	43.34	56.42	58.68	60.94	98.54
44	8.14	19.32	27.42	35.86	44.28	57.67	60.18	62.19	100.80
45	8.29	19.74	28.01	36.62	45.22	58.92	61.43	63.44	103.06
46	8.44	20.17	28.60	37.38	46.16	60.17	62.68	64.69	105.32
47	8.59	20.59	29.19	38.14	47.10	61.42	63.93	65.94	107.58
48	8.74	21.02	29.78	38.90	48.04	62.67	65.18	67.19	109.84
49	8.89	21.44	30.37	39.66	48.98	63.92	66.43	68.44	112.10
50	9.04	21.87	30.96	40.42	49.92	65.17	67.68	69.69	114.36
51	9.19	22.29	31.55	41.18	50.86	66.42	68.93	70.94	116.62
52	9.34	22.72	32.14	41.94	51.80	67.67	70.18	72.19	118.88
53	9.49	23.14	32.73	42.70	52.74	68.92	71.43	73.44	121.14
54	9.64	23.57	33.32	43.46	53.68	70.17	72.68	74.69	123.40
55	9.79	23.99	33.91	44.22	54.62	71.42	73.93	75.94	125.66
56	9.94	24.42	34.50	44.98	55.56	72.67	75.18	77.19	127.92
57	10.09	24.84	35.09	45.74	56.50	73.92	76.43	78.44	130.18
58	10.24	25.27	35.68	46.50	57.44	75.17	77.68	79.69	132.44
59	10.39	25.69	36.27	47.26	58.38	76.42	78.93	80.94	134.70
60	10.54	26.12	36.86	48.02	59.32	77.67	80.18	82.19	136.96
61	10.69	26.54	37.45	48.78	60.26	78.92	81.43	83.44	139.22
62	10.84	26.97	38.04	49.54	61.20	80.17	82.68	84.69	141.48
63	10.99	27.39	38.63	50.30	62.14	81.42	83.93	85.94	143.74
64	11.14	27.82	39.22	51.06	63.08	82.67	85.18	87.19	146.00
65	11.29	28.24	39.81	51.82	64.02	83.92	86.43	88.44	148.26
66	11.44	28.67	40.40	52.58	64.96	85.17	87.68	89.69	150.52
67	11.59	29.09	40.99	53.34	65.90	86.42	88.93	90.94	152.78
68	11.74	29.52	41.58	54.10	66.84	87.67	90.18	92.19	155.04
69	11.89	29.94	42.17	54.86	67.78	88.92	91.43	93.44	157.30
70	12.04	30.37	42.76	55.62	68.72	90.17	92.68	94.69	159.56
71	12.19	30.79	43.35	56.38	69.66	91.42	93.93	95.94	161.82
72	12.34	31.22	43.94	57.14	70.60	92.67	95.18	97.19	164.08
73	12.49	31.64	44.53	57.90	71.54	93.92	96.43	98.44	166.34
74	12.64	32.07	45.12	58.66	72.48	95.17	97.68	99.69	168.60
75	12.79	32.49	45.71	59.42	73.42	96.42	98.93	100.94	170.86
76	12.94	32.92	46.30	60.18	74.36	97.67	100.18	102.19	173.12
77	13.09	33.34	46.89	60.94	75.30	98.92	101.43	103.44	175.38
78	13.24	33.77	47.48	61.70	76.24	100.17	102.68	104.69	177.64
79	13.39	34.19	48.07	62.46	77.18	101.42	103.93	105.94	179.90
80	13.54	34.62	48.66	63.22	78.12	102.67	105.18	107.19	182.16
81	13.69	35.04	49.25	63.98	79.06	103.92	106.43	108.44	184.42
82	13.84	35.47	49.84	64.74	80.00	105.17	107.68	109.69	186.68
83	13.99	35.89	50.43	65.50	80.94	106.42	108.93	110.94	188.94
84	14.14	36.32	51.02	66.26	81.88	107.67	110.18	112.19	191.20
85	14.29	36.74	51.61	67.02	82.82	108.92	111.43	113.44	193.46
86	14.44	37.17	52.20	67.78	83.76	110.17	112.68	114.69	195.72
87	14.59	37.59	52.79	68.54	84.70	111.42	113.93	115.94	197.98
88	14.74	38.02	53.38	69.30	85.64	112.67	115.18	117.19	200.24
89	14.89	38.44	53.97	70.06	86.58	113.92	116.43	118.44	202.50
90	15.04	38.87	54.56	70.82	87.52	115.17	117.68	119.69	204.76
91	15.19	39.29	55.15	71.58	88.46	116.42	118.93	120.94	207.02
92	15.34	39.72	55.74	72.34	89.40	117.67	120.18	122.19	209.28
93	15.49	40.14	56.33	73.10	90.34	118.92	121.43	123.44	211.54
94	15.64	40.57	56.92	73.86	91.28	120.17	122.68	124.69	213.80
95	15.79	40.99	57.51	74.62	92.22	121.42	123.93	125.94	216.06
96	15.94	41.42	58.10	75.38	93.16	122.67	125.18	127.19	218.32
97	16.09	41.84	58.69	76.14	94.10	123.92	126.43	128.44	220.58
98	16.24	42.27	59.28	76.90	95.04	125.17	127.68	129.69	222.84
99	16.39	42.69	59.87	77.66	95.98	126.42	128.93	130.94	225.10
100	16.54	43.12	60.46	78.42	96.92	127.67	130.18	132.19	227.36

2. PedDose App



3. Dosage Calculator online

<https://www.eanm.org/publications/dosage-calculator/>

Dosage Calculator

Calculation of the administered activity in [MBq] and [mCi]

Weight

please select

Radiopharmaceutical

please select

Ok

Jacobs F, Thierens H, Piepsz A, Bacher K, Van de Wiele C, Ham H, Dierckx RA. Optimized tracer-dependent dosage cards to obtain weightindependent effective doses. Eur J Nucl Med Mol Imaging. 2005 May; 32(5):581-8.

M. Lassmann, S.T.Treves. Pediatric Radiopharmaceutical Administration: Harmonization of the 2007 EANM Paediatric Dosage Card (Version 1.5.2008) and the 2010 North America Consensus guideline, Eur J Nucl Med Mol Imaging. 2014, DOI: 10.1007/s00440-014-2711-9.

Lassmann M, Biassoni L, Monsieurs M, Franzius C; EANM Dosimetry and Paediatrics Committees. The new EANM paediatric dosage card: additional notes with respect to F-18. Eur J Nucl Med Mol Imaging. 2008 Sep;35(9):1666-8. doi: 10.1007/s00259-008-0799-9. Epub 2008 Jun 24. Erratum in: Eur J Nucl Med Mol Imaging. 2008 Nov;35(11):2141

DOSAGE CARD - COMO USARLA

1. Pesar al niño
2. Escoger el RADIOFÁRMACO de la lista
3. Tomar nota de la CLASS, de la BASELINE ACTIVITY y de la MINIMUM RECOMENDED ACTIVITY
4. Calculo:
 - Escoger la línea con el peso
 - Escoger la columna con la clase (CLASS) del radiofármaco
 - Multiplicar la baseline activity con el múltiplo que figura en la tabla, en la intersección de peso (línea) y clase (columna)
 - Si la actividad resultante es más pequeña que la minimum recommended activity, entonces se debe administrar la minimum recommended activity
 - No sobrepasen los niveles de referencia nacionales



DOSAGE CARD - COMO USARLA

1. Peso del niño
2. Escoger el RADIOFÁRMACO de la lista
3. Tomar nota de la CLASS, de la BASELINE ACTIVITY y de la MINIMUM RECOMENDED ACTIVITY
4. Calculo:
 - Escoger la línea con el peso

Ejemplo:

Gammagrafía ósea
 ^{99m}Tc -MDP

minimum recommended activity, entonces se debe administrar la minimum recommended activity

- No sobrepasen los niveles de referencia nacionales

<https://www.eanr>

Radiopharmaceutical	Class	Baseline Activity, (for calculation purposes only) MBq	Minimum Recommended Activity ¹ MBq
^{123}I (Thyroid)	C	0.6	3
^{123}I Amphetamine (Brain)	B	13.0	18
^{123}I HIPURAN (Abnormal renal function)	B	5.3	10
^{123}I HIPURAN (Normal renal function)	A	12.8	10
^{123}I mIBG	B	28.0	37
^{123}I mIBG	B	5.6	35
^{18}F FDG-PET torso	B	25.9	26
^{18}F FDG-PET brain	B	14.0	14
^{18}F Sodium fluoride	B	10.5	14
^{67}Ga Citrate	B	5.6	10
^{67}Ga -labelled peptides	B	12.8	14
^{99m}Tc ALBUMIN (Cardiac)	B	56.0	80
^{99m}Tc COLLOID (Gastric Reflux)	B	2.8	10
^{99m}Tc COLLOID (Liver/Spleen)	B	5.6	15
^{99m}Tc COLLOID (Marrow)	B	21.0	20
^{99m}Tc DMSA	B	6.8	18.5
^{99m}Tc DTPA (Abnormal renal function)	B	14.0	20
^{99m}Tc DTPA (Normal renal function)	A	34.0	20
^{99m}Tc ECD	B	51.8	100
^{99m}Tc HMPAO (Brain)	B	51.8	100
^{99m}Tc HMPAO (WBC)	B	35.0	40
^{99m}Tc IDA (Biliary)	B	10.5	20
^{99m}Tc MAA / Microspheres	B	5.6	10
^{99m}Tc MAG3	A	11.9	15
^{99m}Tc MDP	B	35.0	40
^{99m}Tc Pertechnetate (Cystography)	B	1.4	20
^{99m}Tc Pertechnetate (Ectopic Gastric Mucosa)	B	10.5	20
^{99m}Tc Pertechnetate (Cardiac First Pass)	B	35.0	80
^{99m}Tc Pertechnetate (Thyroid)	B	5.6	10
^{99m}Tc RBC (Blood Pool)	B	56.0	80
^{99m}Tc SestaMIBI/Tetrofosmin (Cancer seeking agent)	B	63.0	80
^{99m}Tc SestaMIBI/Tetrofosmin ² (Cardiac rest scan 2-day protocol min)	B	42.0	80
^{99m}Tc SestaMIBI/Tetrofosmin ² (Cardiac rest scan 2-day protocol max)	B	63.0	80
^{99m}Tc SestaMIBI/Tetrofosmin ² (Cardiac stress scan 2-day protocol min)	B	42.0	80
^{99m}Tc SestaMIBI/Tetrofosmin ² (Cardiac stress scan 2-day protocol max)	B	63.0	80
^{99m}Tc SestaMIBI/Tetrofosmin ² (Cardiac rest scan 1-day protocol)	B	28.0	80
^{99m}Tc SestaMIBI/Tetrofosmin ² (Cardiac stress scan 1-day protocol)	B	84.0	80
^{99m}Tc Spleen (Denatured RBC)	B	2.8	20
^{99m}Tc TECHNEGAS (Lung ventilation) ³	B	49.0	100



DOSAGE CARD - COMO USARLA

1. Peso del niño
2. Escoger el RADIOFÁRMACO de la lista
3. Tomar nota de la **CLASS**, de la **BASELINE ACTIVITY** y de la **MINIMUM RECOMENDED ACTIVITY**

4. Calculo:

- Escoger la línea con el peso

^{99m}Tc -MDP para gammagrafia ósea:

- Class B
- Baseline activity 35 MBq
- Minimum Recommended Activity 40 MBq

mínimum recommended activity, entonces se debe administrar la mínimum recommended activity

- No sobrepasen los niveles de referencia nacionales

Radiopharmaceutical	Class	Baseline Activity (for calculation purposes only) MBq	Minimum Recommended Activity ¹ MBq
^{123}I (Thyroid)	C	0.6	3
^{123}I Amphetamine (Brain)	B	13.0	18
^{123}I HIPURAN (Abnormal renal function)	B	5.3	10
^{123}I HIPURAN (Normal renal function)	A	12.8	10
^{123}I mIBG	B	28.0	37
^{131}I mIBG	B	5.6	35
^{18}F FDG-PET torso	B	25.9	26
^{18}F FDG-PET brain	B	14.0	14
^{18}F Sodium fluoride	B	10.5	14
^{67}Ga Citrate	B	5.6	10
^{68}Ga -labelled peptides	B	12.8	14
^{99m}Tc ALBUMIN (Cardiac)	B	56.0	80
^{99m}Tc COLLOID (Gastric Reflux)	B	2.8	10
^{99m}Tc COLLOID (Liver/Spleen)	B	5.6	15
^{99m}Tc COLLOID (Marrow)	B	21.0	20
^{99m}Tc DMSA	B	6.8	18.5
^{99m}Tc DTPA (Abnormal renal function)	B	14.0	20
^{99m}Tc DTPA (Normal renal function)	A	34.0	20
^{99m}Tc ECD	B	51.8	100
^{99m}Tc HMPAO (Brain)	B	51.8	100
^{99m}Tc HMPAO (WBC)	B	35.0	40
^{99m}Tc IDA (Biliary)	B	10.5	20
^{99m}Tc MAA / Microspheres	B	5.6	10
^{99m}Tc MAG3	A	11.9	
^{99m}Tc MDP	B	35.0	
^{99m}Tc Pertechnetate (Cystography)	B	1.4	20
^{99m}Tc Pertechnetate (Ectopic Gastric Mucosa)	B	10.5	20



DOSAGE CARD - COMO USARLA

1. Peso del niño
2. Escoger el RADIOFÁRMACO de la lista
3. Tomar nota de la CLASS, de la BASELINE ACTIVITY y de la MINIMUM RECOMENDED ACTIVITY

4. Calculo: Reverso de la Dosage Card

- Escoger la línea con el peso
- Escoger la columna con la clase (CLASS) del radiofármaco
- Multiplicar la baseline activity con el múltiplo que figura en la tabla, en la intersección de peso (línea) y clase (columna)
- Si la actividad resultante es más pequeña que la minimum recommended activity, entonces se debe administrar la minimum recommended activity
- No sobrepasen los niveles de referencia nacionales

Dosage Card (Version 5.7.2016)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33



DOSAGE CARD - COMO USARLA

1. Peso del niño
2. Escoger el RADIOFÁRMACO de la lista
3. Tomar nota de la CLASS, de la BASELINE ACTIVITY y de la MINIMUM RECOMENDED ACTIVITY

4. Calculo:

- Escoger la línea con el peso
- **Escoger la columna con la clase (CLASS) del radiofármaco**
- Multiplicar la baseline activity con el múltiplo que figura en la tabla, en la intersección de peso (línea) y clase (columna)
- Si la actividad resultante es más pequeña que la minimum recommended activity, entonces se debe administrar la minimum recommended activity
- No sobrepasen los niveles de referencia nacionales

Dosage Card (Version 5.7.2016)

Multiple of Baseline Activity



Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33



DOSAGE CARD - COMO USARLA

99mTc-MDP para gammagrafia ósea

- Class B
- Baseline activity 35 MBq
- Minimum Recommended Activity 40 MBq

$$35 \text{ MBq} \times 2,71 = 94,85 \text{ MBq}$$

- Multiplicar la baseline activity con el múltiplo que figura en la tabla, en la intersección de peso (línea) y clase (columna)
- Si la actividad resultante es más pequeña que la minimum recommended activity, entonces se debe administrar la minimum recommended activity
- No sobrepasen los niveles de referencia nacionales

Dosage Card (Version 5.7.2016)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33



DOSAGE CARD - COMO USARLA

99mTc-MDP para gammagrafia ósea

- Class B
- Baseline activity 35 MBq
- Minimum Recommended Activity 40 MBq

$$35 \text{ MBq} \times 2,71 = 94,85 \text{ MBq}$$

$$94,85 \text{ MBq} > 40 \text{ MBq}$$

- Si la actividad resultante es más pequeña que la **mínimum recommended activity**, entonces se debe administrar la **mínimum recommended activity**
- No sobrepasen los niveles de referencia nacionales

Dosage Card (Version 5.7.2016)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33



CÁLCULO DE LA DOSIS

3 opciones

[illegible]

2. PedDose App

The logo for the PedDose App is centered on a dark grey rectangular background. It features a blue rounded rectangle containing the EANM logo (a blue oval with 'EANM' in white and a registered trademark symbol) and the text 'European Association of Nuclear Medicine' below it. Below the blue rectangle, the word 'PedDose' is written in a large, white, sans-serif font.

3. Dosage Calculator online

<https://www.eanm.org/publications/dosage-calculator/>

Dosage Calculator



Calculation of the administered activity in [MBq] and [mCi]

Weight

Radiopharmaceutical

<https://www.eanm.org/publications/dosage-calculator/>

Dosage Calculator

Calculation of the administered activity in [MBq] and [mCi]

please select

please select

Ok

M. Lassmann, S.T.Treves. Pediatric Radiopharmaceutical Administration: Harmonization of the 2007 EANM Paediatric Dosage Card (Version 1.5.2008) and the 2010 North America Consensus guideline, Eur J Nucl Med Imaging. 2014, DOI: 10.1007/s00423-014-1191-9.

Lassmann M, Biassoni L, Monsieurs M, Franzius C; EANM Dosimetry and Paediatrics Committees. The new EANM paediatric dosage card: additional notes with respect to F-18. Eur J Nucl Med Mol Imaging. 2008 Sep;35(9):1666-8. doi: 10.1007/s00259-008-0799-9. Epub 2008 Jun 24. Erratum in: Eur J Nucl Med Mol Imaging. 2008 Nov;35(11):2141

2. PedDose App



PedDose es la versión en App para móviles y tabletas de la EANM Paediatric Dosage Card.

Se ha desarrollado como una herramienta de **guía** para los médicos nucleares, físicos y tecnólogos, facilitando el cálculo de las dosis de radiofármaco a administrar a los pacientes pediátricos

Además, PedDose hace una estimación de la **Effective Dose** que comporta el procedimiento de Medicina Nuclear.

Disminuyan la dosimetría recomendando:

- hidratación durante todo el día de la exploración
- micciones frecuentes



Jacobs F, Thierens H, Piepsz A, Bacher K, Van de Wiele C, Ham H, Dierckx RA. Optimized tracer-dependent dosage cards to obtain weight-independent effective doses. *Eur J Nucl Med Mol Imaging*. 2005 May; 32(5):581-8.

M. Lassmann, S.T. Treves. Pediatric Radiopharmaceutical Administration: Harmonization of the 2007 EANM Paediatric Dosage Card (Version 1.5.2008) and the 2010 North America Consensus guideline, *Eur J Nucl Med Mol Imaging*. 2014, DOI: 10.1007/s00259-014-2731-9.

Lassmann M, Biassoni L, Monsieurs M, Franzius C; EANM Dosimetry and Paediatrics Committees. The new EANM paediatric dosage card: additional notes with respect to F-18. *Eur J Nucl Med Mol Imaging*. 2008 Sep;35(9):1418-31. DOI: 10.1007/s00259-008-0799-9. Epub 2008 Jun 24. Erratum in: *Eur J Nucl Med Mol Imaging*. 2008 Nov;35(11):1441-2.

PedDose - COMO USARLA

1. Escoja el ISOTOPO en la lista (scroll)
2. Escoja el RADIOFARMACO en la lista
3. Escoja el PESO (scroll)

En la pantalla, encontrará información sobre:

- La DOSIS RECOMENDADA
- La DOSIS EFECTIVA

Tc-99m DTPA:
Normal renal function

Recommended activity **34.0 MBq**

Effective dose **0.9 mSv**

Ca-67	DMSA	
Ga-68	DTPA: Abnormal	
Tc-99m	DTPA: Normal	3
	ECD	4
	HMPAO: Brain	6
Isotop	Radiopharmaceutical	Weight/kg

Calculator Info Credits



PedDose - COMO USARLA

1. Escoja el ISOTOPO en la lista (scroll)
2. Escoja el RADIOFARMACO en la lista
3. Escoja el PESO (scroll)

En la pantalla, encontrará información sobre:

- La DOSIS RECOMENDADA
- La DOSIS EFECTIVA

Tc-99m MDP

Recommended activity

40.0 MBq

Minimum Recommended Activity

Effective dose

2.5 mSv

Ga-67	MAA/Microspheres	
Ga-68	MAG3	
Tc-99m	MDP	3
	Technetate: Bone	4
	Technetate: Bone	6
Isotope	Radiopharmaceutical	Weight/kg

Calculator

Info

Credits



PedDose - COMO USARLA

1. Escoja el ISOTOPO en la lista (scroll)
2. Escoja el RADIOFARMACO en la lista
3. Escoja el PESO (scroll)

En la pantalla, encontrará información sobre:

- La DOSIS RECOMENDADA
- La DOSIS EFECTIVA

The screenshot shows the PedDose app interface. At the top, the selected isotope and radiopharmaceutical are 'Tc-99m MDP'. Below this, the 'Recommended activity' is 94.9 MBq and the 'Effective dose' is 2.4 mSv. A table lists available options for Isotope and Radiopharmaceutical, with 'Tc-99m MDP' selected. A red arrow points to the 'Tc-99m MDP' row in the table. Another red arrow points to the 'Weight/kg' column header. The bottom navigation bar includes 'Calculator', 'Info', and 'Credits'.

Isotope	Radiopharmaceutical	Weight/kg
Ga-67	MAA/Microspheres	5
Ga-68	MAG3	8
Tc-99m	MDP	10
	Pertechnetate: Cystography	1
	Pertechnetate: Gastric Mucosa	1

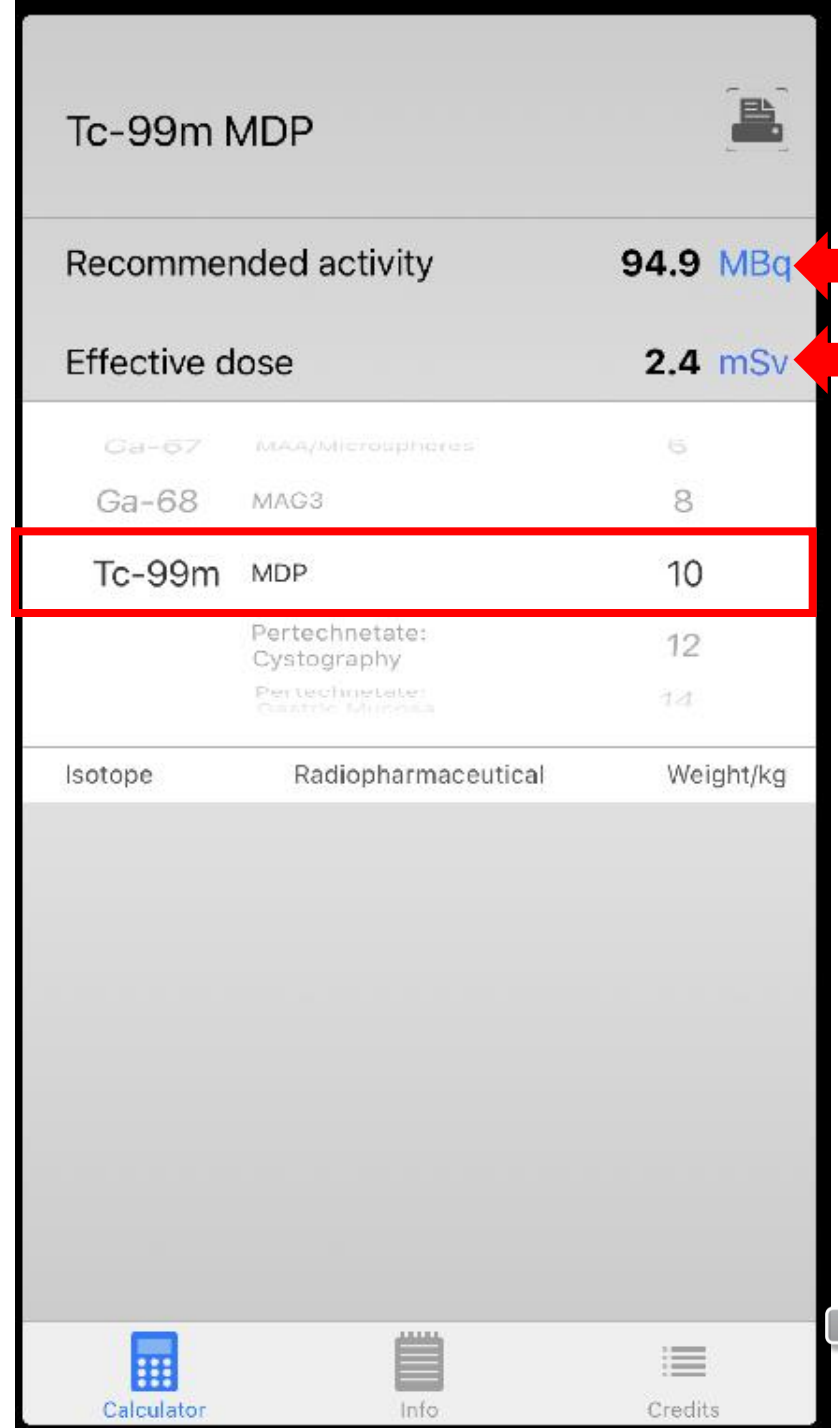


PedDose - COMO USARLA

1. Escoja el ISOTOPO en la lista (scroll)
2. Escoja el RADIOFARMACO en la lista
3. Escoja el PESO (scroll)

En la pantalla, encontrará información sobre:

- La DOSIS RECOMENDADA
- La DOSIS EFECTIVA



The screenshot shows the PedDose app interface. At the top, 'Tc-99m MDP' is selected, with a document icon to its right. Below this, the 'Recommended activity' is displayed as '94.9 MBq' and the 'Effective dose' as '2.4 mSv', both with red arrows pointing to them from the right. A table lists various isotope and radiopharmaceutical combinations with their corresponding weight values. The row for 'Tc-99m MDP' with a value of '10' is highlighted with a red border. Below this, two more rows are visible: 'Pertechnetate: Cystography' with a value of '12' and 'Pertechnetate: Gastric Mucosa' with a value of '14'. At the bottom, there is a table with three columns: 'Isotope', 'Radiopharmaceutical', and 'Weight/kg'. The bottom navigation bar contains three icons: a calculator icon labeled 'Calculator', a document icon labeled 'Info', and a list icon labeled 'Credits'. A speaker icon is located in the bottom right corner of the image.

Tc-99m MDP			
Recommended activity		94.9 MBq	
Effective dose		2.4 mSv	
Ga-67	MAA/Microspheres	6	
Ga-68	MAG3	8	
Tc-99m	MDP	10	
	Pertechnetate: Cystography	12	
	Pertechnetate: Gastric Mucosa	14	
Isotope	Radiopharmaceutical	Weight/kg	

Calculator Info Credits

CÁLCULO DE LA DOSIS

3 opciones

1. DOSAGE CARD




Dosage Card (Version 5.7.2016)

Multiple of Baseline Activity

Week	Class	Class	Class	Week	Class	Class	Class
1g	A	B	C	1g	A	B	C
1	1	1	1	1	1	1	1
2	1.12	1.14	1.31	10	1.88	1.72	1.50
3	1.47	1.71	2.08	11	4.00	3.60	3.00
4	1.71	2.14	3.00	12	4.18	3.83	3.00
10	1.94	2.37	3.67	13	4.29	3.86	3.00
11	2.18	2.64	4.42	14	4.41	4.14	3.00
12	2.35	2.87	5.67	15	4.53	4.37	3.00
13	2.52	4.00	6.50	16	4.65	4.50	3.00
14	2.71	4.45	7.33	18	4.77	4.59	3.00
20	2.88	4.86	8.33	19	4.88	4.71	3.00
21	3.06	5.29	9.33	20	5.00	5.12	3.00
22	3.18	5.70	10.50	24	5.20	5.40	3.00
23	3.35	6.14	11.68	25	5.43	5.71	3.00
24	3.47	6.45	12.90	26	5.61	5.93	3.00
25	3.65	6.86	13.99	27	5.77	6.08	3.00

AMM_{Baseline} = BaselineActivity x Multiple

For a calculation of the administered activity the baseline activity has to be multiplied by the multiple given above for the recommended subtherapeutic doses (see table).

1) If the resulting activity is smaller than the minimum recommended activity, the minimum activity should be administered.

2) The national diagnostic reference levels should not be exceeded.

Examples:

a) 10 TBq/1.70m² activity to be administered [BMG] = 10x10³ / 1.70m²
 50 MBq
 = 130 MBq

b) 10 TBq/1.70m² activity to be administered [BMG] = 10x10³ / [BMG] = 20 MBq
 30 MBq
 = 17 MBq (Minimum Recommended Activity)

Activity to be administered [TBq]

This card is based upon the publication by Jacobs J, Therasse P, Poppe A, Bachelot B, De Waz F, Chavaudra N, O'Connor M. Optimal radioiodine therapy design to achieve an independent effect alone, for 131I whole-body imaging, 2005, *Journal of Nuclear Medicine*.

This card summarizes the results of the EAMM project. Consistency of the BMG and effects measurements for which the EAMM project has been organized.

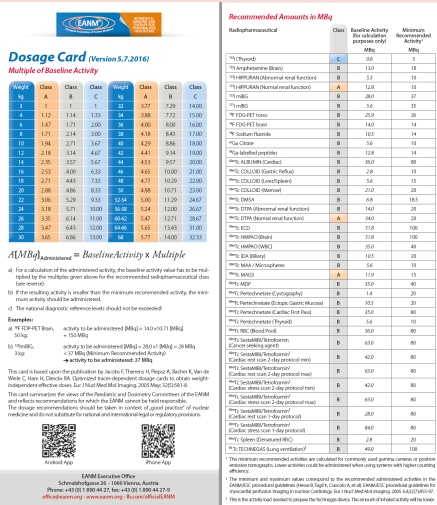
The design recommendations should be taken in context of clinical practice of nuclear medicine and not only as guidelines for national and international regulatory organizations.




Android App
iPhone App

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www.eamm-germany.org info@eamm-germany.org

Recommended Amounts in MBq		Baseline Activity for calculation purposes only	Minimum Recommended Activity
Radioisotope	Class	MBq	MBq
¹³¹ I Thyroid	C	20	2
¹³¹ I Angiostatin (BAC)	C	112	18
¹³¹ I Anti-HER2/neu (normal function)	C	5.5	10
¹³¹ I Anti-HER2/neu (normal function)	A	120	18
¹³¹ I Anti-CD20	C	260	37
¹³¹ I Thyroid	B	30	30
¹³¹ I T407 (T407)	B	250	25
¹³¹ I T407 (T407)	B	140	14
¹³¹ I Sodium Iodide	B	102	14
¹³¹ I Chlorine	C	16	13
¹³¹ I Anti-CD20 (normal function)	C	120	14
¹³¹ I Anti-CD20 (normal function)	C	360	80
¹³¹ I Anti-CD20 (normal function)	C	120	14
¹³¹ I Anti-CD20 (normal function)	C	56	15
¹³¹ I Anti-CD20 (normal function)	C	210	25
¹³¹ I Anti-CD20 (normal function)	C	400	140
¹³¹ I Anti-CD20 (normal function)	C	140	25
¹³¹ I Anti-CD20 (normal function)	C	960	20
¹³¹ I Anti-CD20 (normal function)	C	510	100
¹³¹ I Anti-CD20 (normal function)	C	510	100
¹³¹ I Anti-CD20 (normal function)	C	200	40
¹³¹ I Anti-CD20 (normal function)	C	100	25
¹³¹ I Anti-CD20 (normal function)	C	74	13
¹³¹ I Anti-CD20 (normal function)	A	119	15
¹³¹ I Anti-CD20 (normal function)	C	200	40
¹³¹ I Anti-CD20 (normal function)	C	14	20
¹³¹ I Anti-CD20 (normal function)	C	102	20
¹³¹ I Anti-CD20 (normal function)	C	210	80
¹³¹ I Anti-CD20 (normal function)	C	510	100
¹³¹ I Anti-CD20 (normal function)	C	510	100
¹³¹ I Anti-CD20 (normal function)	C	200	40
¹³¹ I Anti-CD20 (normal function)	C	14	20
¹³¹ I Anti-CD20 (normal function)	C	102	20
¹³¹ I Anti-CD20 (normal function)	C	210	80
¹³¹ I Anti-CD20 (normal function)	C	510	100
¹³¹ I Anti-CD20 (normal function)	C	510	100
¹³¹ I Anti-CD20 (normal function)	C	200	40
¹³¹ I Anti-CD20 (normal function)	C	14	20
¹³¹ I Anti-CD20 (normal function)	C	102	20
¹³¹ I Anti-CD20 (normal function)	C	210	80
¹³¹ I Anti-CD20 (normal function)	C		

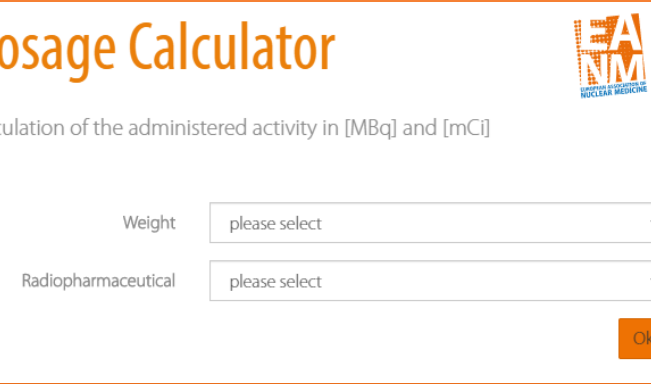


2. PedDose App

The logo for the PedDose App is displayed on a dark green rectangular background. At the top, the EANM logo is shown, which consists of a blue rounded rectangle containing the text "EANM" in white, with a registered trademark symbol (®) to its upper right. Below "EANM" is the text "European Association of Nuclear Medicine" in a smaller white font. Below the blue rectangle, the word "PedDose" is written in a large, white, sans-serif font.

3. Dosage Calculator online

<https://www.eanm.org/publications/dosage-calculator/>



The screenshot shows the 'Dosage Calculator' interface on the EANM website. The title 'Dosage Calculator' is in large orange letters. Below it, the text 'Calculation of the administered activity in [MBq] and [mCi]' is displayed. There are two input fields: 'Weight' and 'Radiopharmaceutical', both with a 'please select' dropdown menu. An 'Ok' button is located at the bottom right. The EANM logo is in the top right corner.

Dosage Calculator

Calculation of the administered activity in [MBq] and [mCi]

Weight

Radiopharmaceutical

EANM
EUROPEAN ASSOCIATION
OF NUCLEAR MEDICINE

<https://www.eanm.org/publications/dosage-calculator/>

Dosage Calculator

Calculation of the administered activity in [MBq] and [mCi]

Weight

please select
 ▼

Radiopharmaceutical

please select
 ▼

Ok

Calculation of the administered activity in [MBq] and [mCi]

please select

please select

Ok

M. Lassmann, S.T.Treves. Pediatric Radiopharmaceutical Administration: Harmonization of the 2007 EANM Paediatric Dosage Card (Version 1.5.2008) and the 2010 North America Consensus guideline, Eur J Nucl Med Imaging. 2014, DOI: 10.1007/s00423-014-1109-9.

DOSAGE CALCULATOR ONLINE - COMO USARLO

1. Escoja el PESO

2. Escoja el RADIOFÁRMACO

La pantalla le informa de:

- La ACTIVIDAD RECOMENDADA en MBq y en mCi

Dosage Calculator

Calculation of the administered activity in [MBq] and [mCi]

Weight

10 kg



Radiopharmaceutical

please select



Ok



DOSAGE CALCULATOR ONLINE - COMO USARLO

1. Escoja el PESO
2. Escoja el RADIOFÁRMACO

La pantalla le informa de:

- La ACTIVIDAD RECOMENDADA en MBq y en mCi

Dosage Calc

Calculation of the administered

Weight

Radiopharmaceutical

Tc-99m DTPA (Abnormal renal function)

Tc-99m DTPA (Normal renal function)

Tc-99m ECD

Tc-99m HMPAO (Brain)

Tc-99m HMPAO (WBC)

Tc-99m IDA (Biliary)

Tc-99m MAA / Microspheres

Tc-99m MAG3

Tc-99m MDP

Tc-99m Pertechnetate (Cystography)

please select

Ok



DOSAGE CALCULATOR ONLINE - COMO USARLO

1. Escoja el PESO
2. Escoja el RADIOFÁRMACO

La pantalla le informa de:

- La ACTIVIDAD RECOMENDADA en MBq y en mCi

Dosage Calculator

Calculation of the administered activity in [MBq] and [mCi]

Weight	10 kg
Radiopharmaceutical	Tc-99m MDP
	Ok



Activity to be administered:
= 95 MBq or 2.57 mCi



REDUCCIÓN DE DOSIS EN IMAGEN HÍBRIDA

CT:

- CT diagnóstico de BAJA dosis
 - Linfoma
 - síndrome linfoproliferativo
 - Neuroblastoma
 - Sarcomas
 - Histiocitosis
 - ...

CT:

- Dosimetría x2 o x3 FDG dosimetría

QUÉ DEBEMOS HACER?

- KV y mA:
 - consenso con Radiología Pediátrica
- ajustar el grosor de los cortes
- ajustar la distancia entre cortes



PET-CT: técnica del CT

CT:

- evitar reconstrucciones con cortes demasiado estrechos
 - grosor del corte ↓ ► ruido de la imagen ↑↑
- ajustar los valores de mA según el tamaño del paciente
 - ↓ mA ► ruido ↑
 - mA/4 ► ruido x2
- ↓ kV es una medida muy eficiente para reducir la dosimetría, en especial en el CT pediátrico



PET-CT: técnica del CT

CT:

- evitar repetir series de CT o realizar varios CT
 - el CT con contraste puede utilizarse para AC corrección de atenuación
 - no repitan exploraciones diagnósticas, actúen coordinadamente con el Dept de Radiología Pediátrica
- realizar un CT de cuerpo entero solo para AC puede comportar una baja dosimetría:
 - < 1 mSv
- un CT de cuerpo entero con información diagnóstica comporta una mayor dosimetría:
 - < 7 mSv



PET-CT: técnica del CT

CT:

- algunos equipos disponen de:
 - ajuste automatico del miliamperaje mA
 - reducción de dosis de hasta el 45%
- La reconstrucción iterativa es muy superior >>> a la FBP filtered back reconstruction para el CT y comporta una importante reducción de dosis:
 - 65% reducción dosis



MNP: *Justificación y optimización*

JUSTIFICACIÓN

→ **VALIDACIÓN** de la petición

OPTIMIZACIÓN de la DOSIMETRÍA

Imagen de MN

→ **MINIMA DOSIS** de radiofármaco

Imagen híbrida

→ Disminuir la **DOSIMETRIA DEL CT**

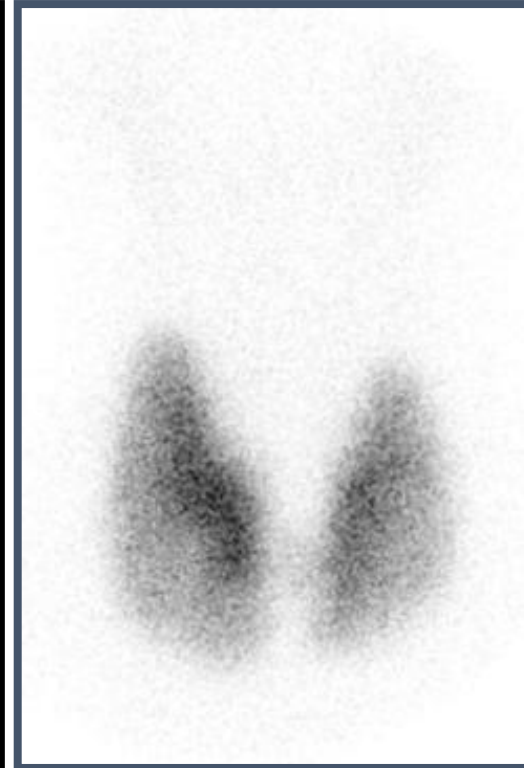
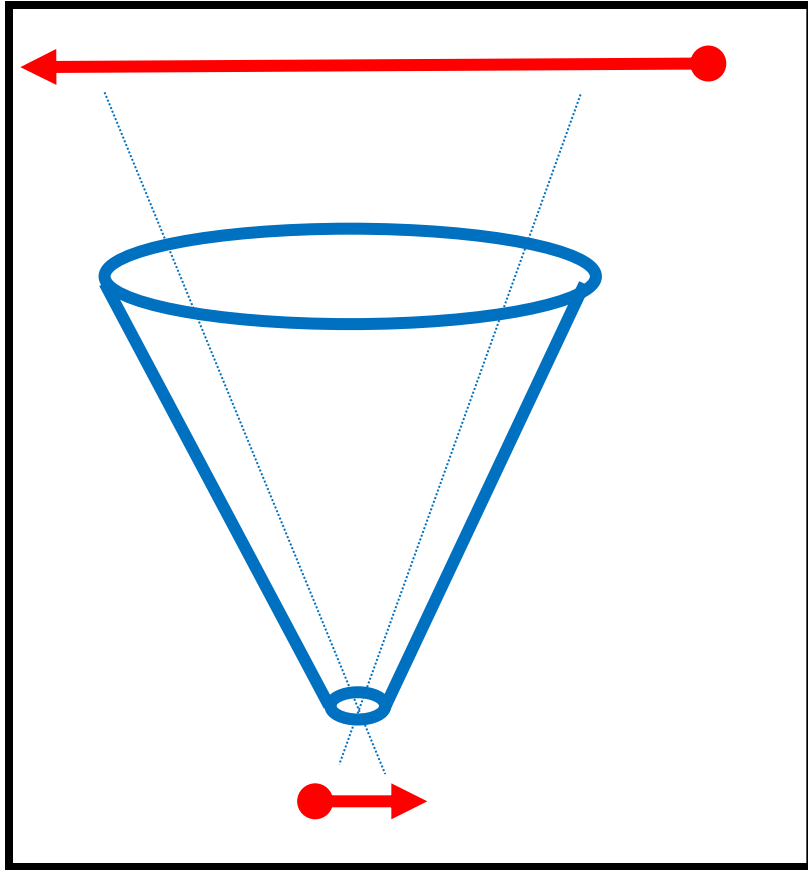
OPTIMIZACIÓN de la IMAGEN

→ Obtener la **IMAGEN CON LA MEJOR CALIDAD POSIBLE**



COLIMADOR PIN-HOLE

para huesos pequeños, cabeza femoral, tiroides o riñones en lactantes

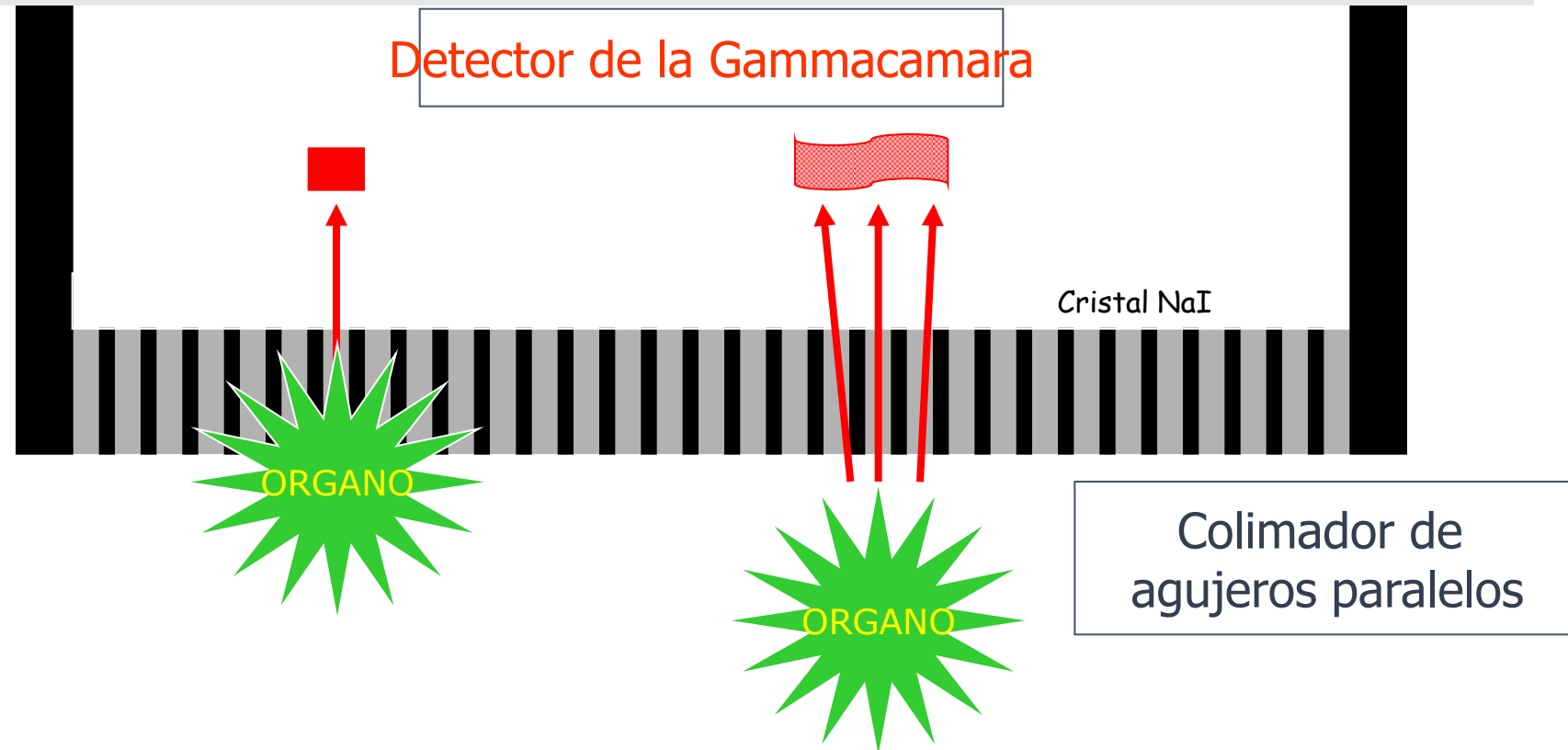


NIÑOS:

- pequeños órganos
- baja actividad inyectada
- pocas cuentas
- tiempo de detección limitado
evitar movimientos

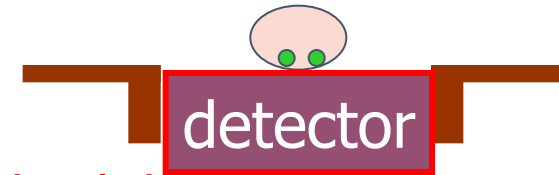
Resolución de la imagen Optimización de la calidad

- mínima distancia entre
el órgano a estudiar
y el detector



POSICIONAMIENTO

Ejemplo: DETECCIÓN RENAL POSTERIOR



1. Cama de madera con un agujero central adaptado al detector
2. Camilla de Lucite (radiotransparente)
3. Camilla Tomografica

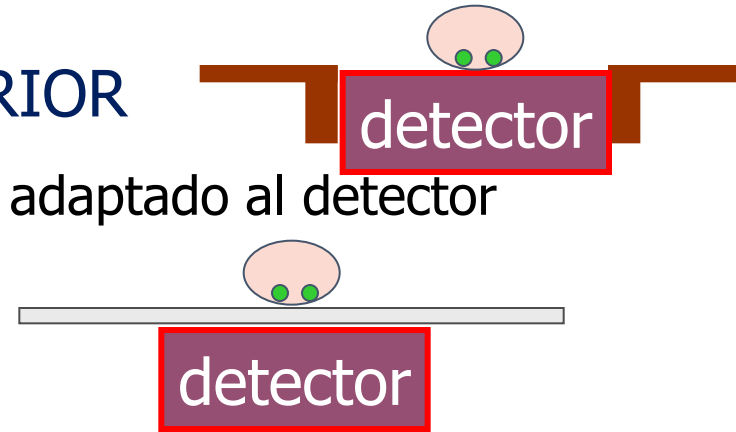
**DISTANCIA MINIMA ENTRE
EL ORGANO
Y
EL DETECTOR !!!**



POSICIONAMIENTO

Ejemplo: DETECCIÓN RENAL POSTERIOR

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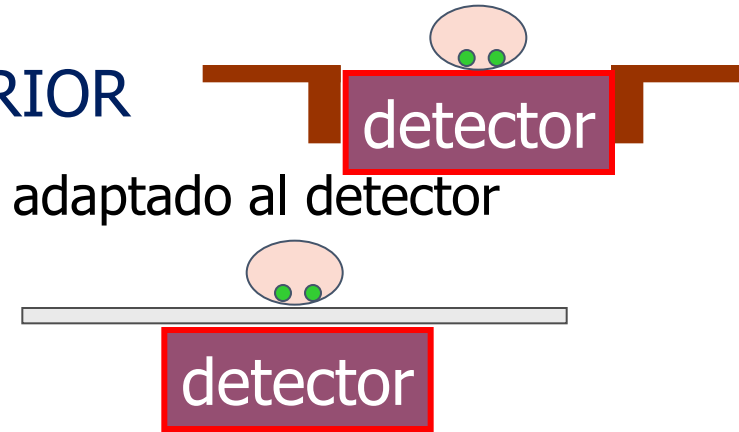
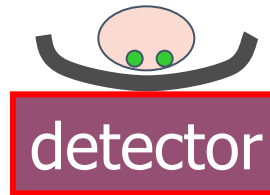
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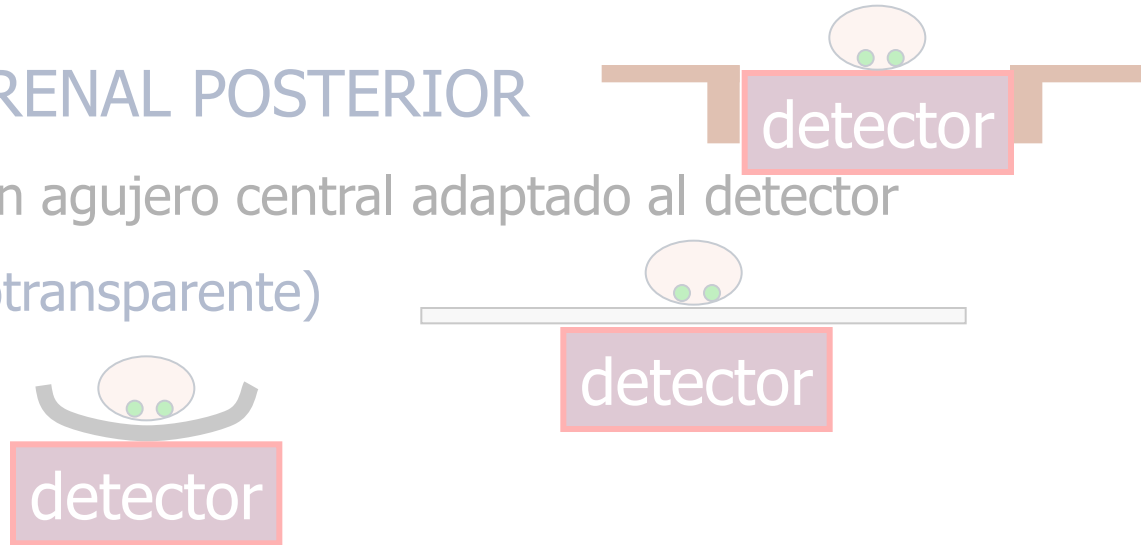
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POSICIONAMIENTO

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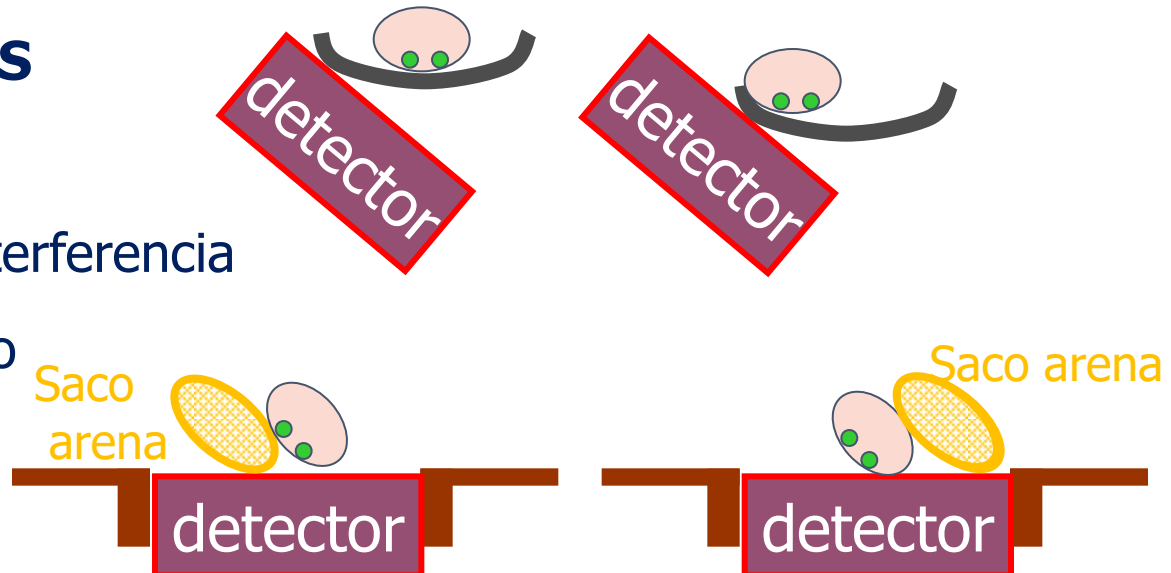
1. Cama de madera con un agujero central adaptado al detector
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DETECCIONES OBLÍCUAS

1. Minimizar la distancia
2. ATENCIÓN! Evitar la interferencia

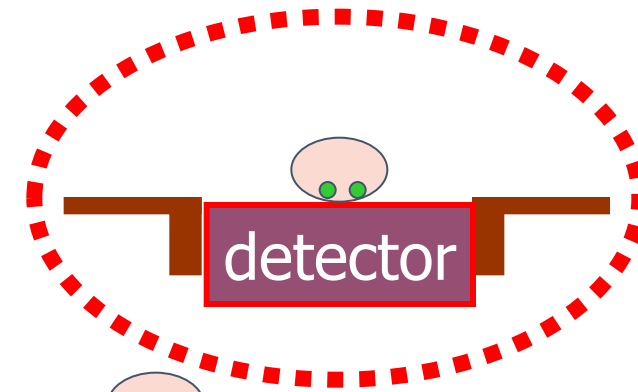
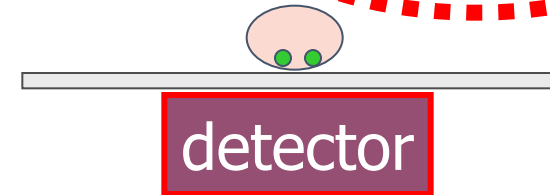
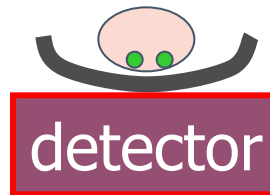
de sacos de arena o
de otro material
atenuante



MEJOR POSICIONAMIENTO

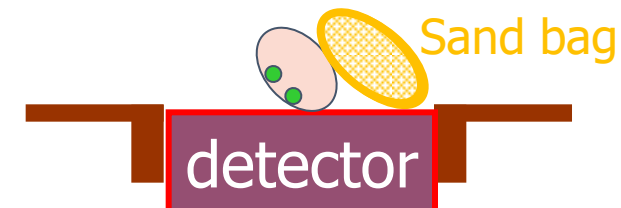
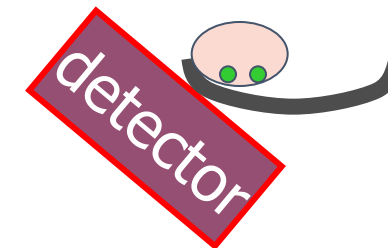
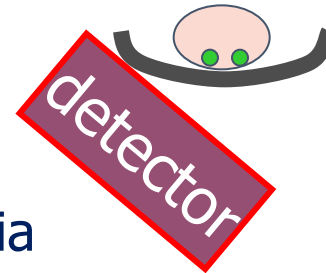
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DETECCIONES OBLÍCUAS

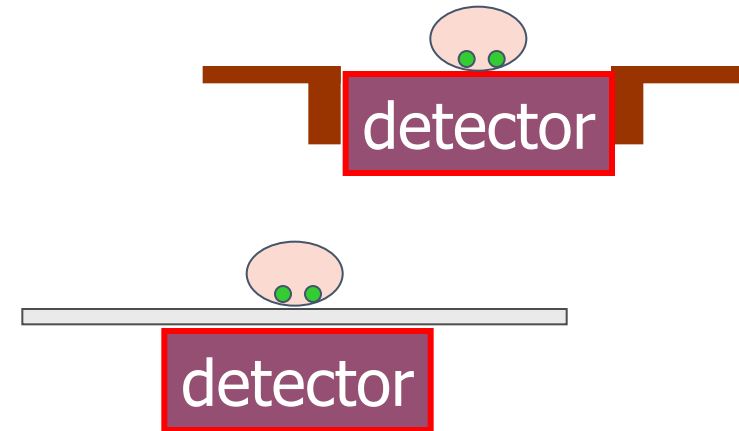
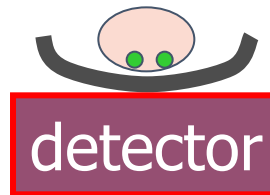
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MEJOR POSICIONAMIENTO

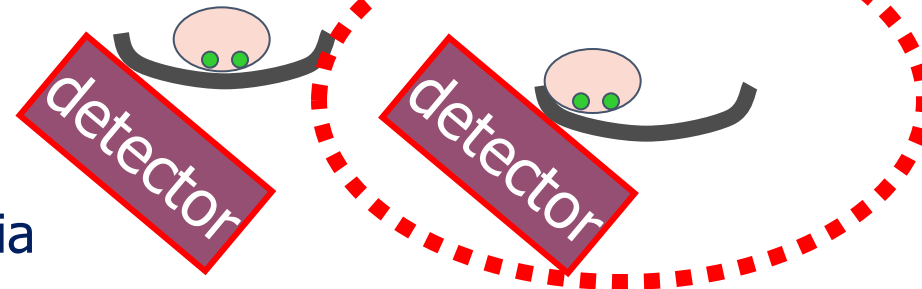
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DETECCIONES OBLÍCUAS

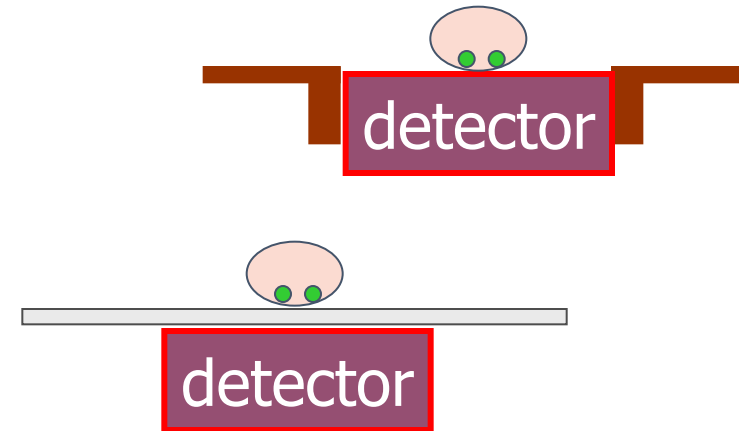
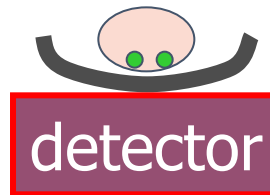
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MEJOR POSICIONAMIENTO

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