

급성 방사선증후군 및 내부피폭의 진단과 치료

Diagnostic and Therapeutic Management of Acute Radiation Syndrome and Internal Contamination

3 388 - 1

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Abstract

The ARS(Acute Radiation Syndrome) develops, within 60 days after exposure to ionising radiation with typical clinical signs and symptoms as a function of time. The interactions and combined effects of radiation - induced damage to different organ systems are diverse and not yet fully understood. Therefore, when accidental exposure to ionising radiation is documented or suspected, guidance for immediate diagnostic procedures and specialised care are required to handle the complexity of the ARS. The following four organ systems, Neurovascular system (N), Hematopoietic system (H), Cutaneous system (C) and Gastrointestinal system (G) are considered to be of critical significance for the development of ARS and should therefore receive special attention in the medical management of radiation accident cases. The Assessment of the severity of damage, Decision on the kind of hospitalisation, Provision of appropriate therapeutic interventions and Evaluation of the patient's prognosis must be considered in the management of a patient after a radiation accident. When significant levels of radioactive materials are incorporated, pathological consequences may ensue, making emergent treatment particularly important. However, this should not take priority over treatment of life threatening conditions and of acute injuries. Following medical stabilization, careful radiological assessment can be performed to determine the presence of both external and internal contamination. It is important to note that 1) contaminated patients do not represent a direct hazard to health care providers and 2) lifesaving procedures should not be delayed regardless of the level of contamination.

Keywords : Acute Radiation Syndrome; Neurovascular system;
Hematopoietic system; Cutaneous system;
Gastrointestinal system and Internal contamination

1.

가

100 rad(1 Gy)

60

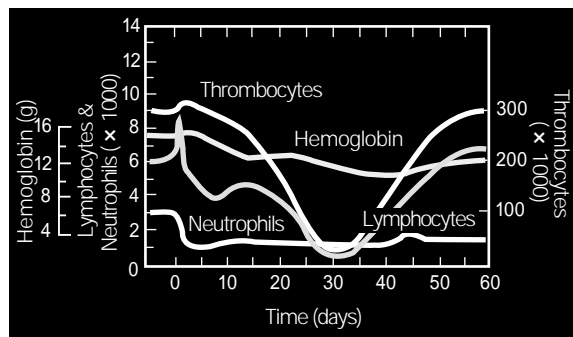
47가

47가

1. 4가			
()		1	2
()	가		
()			
			500 rad
		(5 Gy)	
			150 rad
		(1.5 Gy)	
2. ()			800 rad(8 Gy)
rad (Gy)			
5'~25 (0.05'~0.25)			
50'~75 (0.50'~0.75)	가		
75'~125 (0.75'~1.25)	10'~20% 2 ()		
			50 rad(0.5 Gy)
125'~200 (1.25'~2.00)	48 50%		24
240'~340 (2.4'~3.4)	48 75%		가
>500 (>5)	2	(3).	가
>5000 (>50)		500	
		가	
	가		
	가가		30
			30
	가		
	가	60 (1).	
		500 rad(5 Gy)	
2. 가			
4가		1,300 rad(13 Gy)	

3.	48	가
	/mm ³	가
1,500~3,000		
1,000~1,500		;
500~1,000		;
100~500		;
100		

4.		
	γ	
	1'~4	
	2'~3	
	2	3
	8'~15	6



1. (3 Gy)

가 .

5,000 rad(50 Gy)

가

,

가

.

2,000 rad(20 Gy)

8 48

,

,

.

4가

,

,

,

(

4)

.

1 3

,

가

가 가

.

가

400 rad(4 Gy)

가 1

48

3

600 rad(6 Gy)

1

.

24 , 48

가

24

48

,

,

(5, 6),

LD50/60

60

가

250~350 rad

(2.5~3.5 Gy) , (reverse isolation),

450 rad(4.5 Gy) 가

가 LD50/60

1,100 rad(11.0 Gy) 가

5.

50'~100 rad(0.5'~1.0 Gy)	15'~50	3'~18 hr
	5'~30	3'~20 hr
	15'~20	4'~16 hr
100'~200 rad(1'~2 Gy)	50'~90	1'~48 hr
	30'~70	4'~30 hr
	20'~50	6'~24 hr
	25'~60	3'~72 hr
	25'~50	3'~48 hr
()	10	1'~5 wk
	10'~50	2 days'~5 wk
	10'~50	1'~5 wk
	<5	5'~6 wk
200'~350 rad(2'~3.5 Gy)	90'~100	1'~48 hr
	70'~90	1'~48 hr
	50'~80	3'~24 hr
	10	4'~8 hr
()	60'~90	2 hr'~6 wk
()	50'~80	2 hr'~6 wk
	10'~50	1'~5 wk
	10'~80	1'~5 wk
	10'~80	2'~5 wk
	30	3'~5 wk
	5'~50	4'~6 wk
350'~550 rad(3.5'~5.5 Gy)	100	1'~72 hr
	90'~100	1'~72 hr
	80'~100	3'~24 hr
	10	3'~8 hr
	90'~100	1 hr'~6 wk
	90'~100	1 hr'~6 wk
	50	4'~24 hr
	50'~100	6 days'~6 wk
	80'~100	6 days'~6 wk
	50'~99	3.5'~6 wk
550'~750(5.5'~7.5 Gy)	100	1'~72 hr
	100	1'~72 hr
	100	1'~48 hr
	10	4'~6 hr
()		1 hr'~2 wk
	100	4'~48 hr
	80	4'~30 hr
	100	10'~14 days
	100	2'~3 wk

, 가 .
10 ml
가
.
1
, LET
가
,
가
.
가,
가
가
.
가 가
.
3.
가 , ,

6. Thoma Wald

	()	(rad)
I		150
가		
II		400
III		400~600
IV	가	600~1,500
V		>5,000

가

() HLA 가

가

diphenhydramine, nembutal, lorazepam

perphenazine, acetamino-

phen, morphine sulfate,

simethicon, sucralfate

가

가

HLA

가 가 (packed,)

가 2

가

HLA 가

500

10%

가

(linoleic acid cream), 5,000 rad

• Symptoms	Grading (organ specific)	Grading Code	Response Category
• N	Ni	Ni Hi Ci Gi	RC=? xd
• H	Hi		
• C	Ci		
• G	Gi		
• N=Neurovascular system	i=Degree of severity 1 - 4		
• H=Hematopoietic system	xd=Time point (x) at which RC was established		
• C=Cutaneous system	measured in days (d) after beginning of exposure		
• G=Gastrointestinal system			
• Example : N2	N2H3C1G2	RC?	

2. Response Category

가 10%

(cyto-

megalovirus)

가 colony stimulation factor

(genta- stem cell factor cytokines

mycin, vancomycin, nystatin)

(nystatin suspension or betadine washes)

4. 가 :

Response Category

European Commission 가

(acyclovir) METREPOL(Medical Treatment Protocols

(trimethoprim - sul- for radiation accident victims as a basis for a com-

famethoxazole) puterised guidance system)

RC(Response Category)

RC (N),

(H), (G), (C) 4가

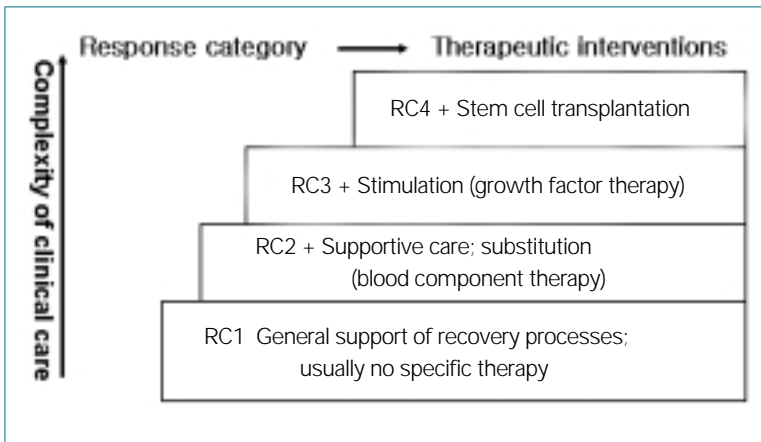
4 (d :)

가

(2).

6 , 1 12

가 가



3. Response Category

RC

(Whole Body counting),

가

Gamma Camera Scanning

(3).

가

(International Commission

on Radiation Protection) (ICRP 30)

MIRD(Medical Internal Radiation Dosimetry)

1.

가

4 (7).

3.

가

3

(>10 μm)

(<1 μm)

gamma

camera scanning

가

7.

100 mSv

Inhaled	Phosphorous	Iodine	Ruthenium	Carbon
Insolubles	Calcium	Astatine	Silver	Sodium
	Strontium		Rare Earths	Zinc
	Radium		Cobalt	Cesium
	Plutonium		Ingested	
	(Soluble)		Insolubles	

8.

Prussian Blue ; Cs, Rb
 Sodium Alginate ; Sr
 Calcium gluconate ; Sr, Ca
 D - Penicillamine ; Co, Cu, Fe, Hg, Pb, Au, Ga
 KI ; I
 Deferoxamine mesilate ; Fe, Pu, Cr, Th
 Sodium Thiosulfate ; As
 BAL(Dimercaprol) ; As, Au, Pb, Hg, Po
 Zinc Sulfate ; Zn
 DTPA ; Am, Ca, Cf, Ce, Cr, Cm, Eu, In, La, Pb,
 Mn, Hg, Pu, Pm, Sc, Th, U, Y, Zn, Zr
 DTPA - Zn ; Zn
 Barium Sulfate ; Blocking of Absorption
 Aluminum Hydroxide ; Sr
 Activated Charcoal ; Cr
 Diuretics ; Na, Ru, K, H, Br, Ca
 Parathyroid Hormone ; P
 Purgative Drugs ; Ba, Ca, Cf, Ce, Cs, Co, Cm,
 Eu, La, Po, K, Ra, Pn, S, Lu, Sc

가

() 10%
 1 50% 가
 24
 가
 Potassium Iodide(KI)
 tablet (1 130 mg)
 KI 1 100 mg
 (1~4)
 1 1
 (IAEA) KI 1 65 mg 2
 , 1 , 1/2 1/4

가 scanning

가 1 1 scanning 가 2) 가 (Xe, Kr)

가

8 ,

가

가

1) (I - 131)

I - 131

3) (: H - 3)

H

가

(3~4 L/day)

가

4) (Cs - 137, Cs - 134 >> Na - 24,
Na - 22, Rb - 87)

6) (Transuranic Elements :

(chelating agent)

Ca - DTPA

Zn - DTPA

1 gm Ca -

(PB) DTPA

2~3%

1 gm Ca - DTPA

1

1 g

5

가

3

Ca - DTPA가

Zn - DTPA

Zn - DTPA

1/3

5)

7)

1.4% Sodium Bicarbonate

250 ml

(乳酸)

1 , 500~

1,500 mg

1 600 mg 6

가

가
·

가
·
가 가

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9 ()

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|----|-----|
| 1. | 6. |
| 2. | 7. |
| 3. | 8. |
| 4. | 9. |
| 5. | 10. |