

Twenty Two Years after Chernobyl Accident Medical Aspect

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INTRODUCTION

Chernobyl accident is the most serious nuclear catastrophe in the recent era. About 600.000 victims intervene in this disaster. The most fatality was about one month after the accident 31 victims. The main cause was Acute Radiation Syndrome.

After few weeks 115.000 persons evacuated from the contaminated areas with exposure dose from 0.07 to 2 Gy.

The main Isotope exposure was I131 and Cs137 with average exposure dose 7 and 10 mGy respectively.

VICTIMES

Workers Involved

Recovery Workers

About 500.000 Recovery Workers involved. With Collective dose 60.000 man Gy

56 % from Ukraine

33% from Russia

11% From Belarus, Lithuania,

Emergency Workers

ARS 134 persons

41 < 2.1 Gy

93 > 2.1 Gy

50 2.2 : 4.1 Gy

22 4.2 : 6.4 Gy

21 6.6 : 16 Gy

Skin dose due to β exposures, for 8 patients ranged 10:30 time's whole body doses due to external irradiation.

Average doses to recovery operation workers

1986 0.17 Sv

1987 0.13 Sv

1988 0.03 Sv

1989 0.015 Sv

General Population

Within a few weeks 116.000 persons evacuated from contaminated areas.

Ukraine 90.000

Belarus 25.000

Russia 200

(A) THYROID DOSES

The average thyroid doses had varied according to their age, place and date of evacuation,

- Pripyat 370 mGy
- Belarus 1077 mGy
- Russia 640 mGy
- Ukraine 333 mGy
- Average 494 mGy

Resident of Pripyat

Evacuated within 48 hours. With average thyroid dose 0.17 Gy (Adult 0.07 Gy and Infants 2 Gy). Where other evacuees 0.47 Gy

(B) EFFECTIVE DOSES

External

- Belarusian 25 mSv
- Russian 25 mSv
- Ukrainen 20 mSv

Internal

- Belarusian 6 mSv
- Russian 10 mSv
- Ukrainen 10 mSv

ACUTE RADIATION SYNDROME

Doses, Number and Outcome of 134 patients with ARS (Moscow)

Degree	Dose Range (Gy)	Number of patients	Deaths	Survivors
Mild (I)	0.8 – 2.1	41	0 (0%)	41
Moderate (II)	2.2 – 4.1	50	1 (2%)	49
Severe (III)	4.2 – 6.4	22	7 (32%)	15
Very severe (IV)	6.5 – 16	21	20 (95%)	1
Total	0.8 - 16	134	28 (21%)	106

Causes of Death

Allogenic bone marrow transplantation was performed on 13 patients

6 patients received human fetal liver cells.

All of them died except one recovered his own marrow and reject the transplant.

2/3 died from transplant complications.

Skin doses causing burns lead to 19 deaths due to infection

LATE HEALTH EFFECTS

WORKERS WHO SURVIVED ARS

1- Transient Peripheral Pancytopenia

Granulocytopenia,
Thrombocytopenia,
Erythrocytopenia,

Lymphopenia were the most frequently observed during the first 5 years after the accident, but from 5 – 15 years after the accident the prevalence of cytopenia cases gradually decline.

2- Radiation Cataract (Subcapsular Posterior)

The threshold dose due to beta and gamma is 3.5 Gy.

23 cases among confirmed ARS.

3 cases among unconfirmed ARS.

3- Thyroid Abnormality

Hypothyroidism due to high ambient levels of radioiodine occurred in 81 patients of ARS.

One of them the thyroid dose reach 11 Gy.

In the 1st five years hypothyroidism occurred in 4 of 83 patients (4.8%). Hyperthyroidism in one patient (1.2%).

10% of patients suffer hypothyroidism during 2001-2007.

Nodular goiter increased from one case to four in ten patients.

4- Local Skin Injuries

It was the major health consequences.

1st degree causes skin atrophy ranging from smooth to more pronounced changes.

2nd degree pronounced atrophy of skin and areas of hypo- and hyperpigmentation, hyperkeratosis and telangiectasia, scarring, fibrosis and late ulcers.

3rd – 4th degrees lead to areas of fibrous scarring, contractures, persistent and recurring late radiation ulcers.

Up to 2005:

Amputation to 2 patients including lower leg, finger and part of a finger.

Telangiectasia among 20 patients and repeated skin ulcers and fibrosis in 6 patients

The rest suffer skin atrophy and hyperkeratosis.

5- Neuropsychological disorders

Functional disorders such as vegetative and vascular dystonia in the 1st decade.

Cerebral atherosclerosis in the 2nd decade.

Depression in Helicopters pilots constructing sarcophagus.

6- Oncological disease

◆ At 2007 four cases (4.6%) of solid cancer among confirmed ARS survivors (1 kidney, 1 colon and 2 thyroid cancers).

◆ 3 cases of myelodysplastic syndrome,

- ◆ 1 myelomonoblastic leukemia,
- ◆ 1 chronic myeloid leukemia,
- ◆ 2 multiple basal cell carcinoma,
- ◆ 13 solid cancers (4 ARS survivors and 9 unconfirmed ARS).

During 20 years (1987-2006) 19 ARS survivors and 14 unconfirmed ARS have died for various reasons.

7- Non-oncological disease

Increasing age is an important factor influencing the increase in disease incidence over time.

Number of ARS followed up at Moscow

ARS grade	Acute period	1986- 1990	1991-1995	1996- 2000	2001- 2006
I-IV	81	83	30	10	10
Mean age (Year)	17 - 72	35.2	39.6 ± 3.6	44 ± 5	48.7 ± 4.9
Local injury	54	40	18	5	5
Died	27	-	-	1	-

No. of patients of four systems with ARS followed up at Moscow

Diseases	<i>Time periods</i>							
	1986-1990		1991-1995		1996-2000		2001-2006	
	Number of Persons	%	Number of Persons	%	Number of Persons	%	Number of Persons	%
GIT	60	72	23	77	8	80	9	90
CVS	44	53	22	73	9	90	10	100
Endocrine	16	19	3	10	4	40	7	70
Respiratory	11	13	7	23	2	20	3	30

Causes of death among Chernobyl ARS survivors in later period

19 persons died in the period 1990 – 2004 due to various causes aged 26 – 87 (mean age 56.8 years) e.g. sudden cardiac death, lung TB, myelodysplastic syndrome, lung gangrene, liver cirrhosis, acute myelomonoblastic leukemia and neurinoma.

20 years mortality due to somatic diseases among patients surviving different grades of ARS in 1986 (Moscow)

Thyroid cancer incidence in different age groups (age at diagnosis 0-29) of Belarusian, Russian and Ukrainian population between 1982 – 2005.

State	Sex	Parameter	Calendar year period				
			1982 1985	1986 1990	1991 1995	1996 2000	2001 2005
Belarusian	F	No. of cases	2	45	398	574	568
		Crude rate/10 ⁶	0.43	3.92	35.78	55.08	58.14
	M	No. of cases	0	32	192	264	206
		Crude rate/10 ⁶	0.00	2.73	16.93	24.68	20.70
Russian	F	No. of cases	30	60	143	162	186
		Crude rate/10 ⁶	7.0	11.8	29.4	34.6	42.2
	M	No. of cases	3	14	42	57	49
		Crude rate/10 ⁶	0.7	2.6	8.3	11.6	10.7
Ukrainian	F	No. of cases	35	116	481	885	449
		Crude rate/10 ⁶	0.8	2.2	9.0	17.4	23.2
	M	No. of cases	19	49	166	258	122
		Crude rate/10 ⁶	0.4	0.9	3.0	4.9	6.1

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