

limaon ointment and fish liver oil were used with good results. Tetanus and gangrene vaccines were not used, and it was likely that no cases of either happened.

(B) Pseudo-burns

As mentioned above, mineral spring therapy was given. The control group was given applying oil or mercurochrome. As homeopathic treatment, persimmon, mashed cooked rice, potato, pumpkin and fresh soil of clay were used. These had very little effect.

(C) Early onset blood disorder

The anti-coagulants and Vitamin C were of no use. Any other therapies had no effect.

(D) Early onset digestive organ disorder

The patients who had only pustulous blisters on their lips seemed to be in good health at the beginning yet developed stomatitis as if caught off guard. The healing methods of gargling or applying sodium solution or boric acid solution were of no use. Silver nitrate, lugol, mercurochrome and honey, etc. were tried to no avail. Diarrhea, tenesmus, also did not respond to anti-diarrheal drug and patients suddenly died to no avail.

(E) Late onset blood disorder

A small amount of Fowler's solution was given. This was effective. The critical patient partly recovered from the critical condition. We paid special attention to nutrition and recommended liver and vegetable food therapy. It was a time of food shortage. The liver of cow, goat, chicken, and eel were purchased. Bone marrow soup was relished. The period was also a shortage of green vegetables. Cucumbers were used quite often.

For fruit therapy, we purchased pear and persimmon. These were given in large amounts as sources of vitamins. Potato, pumpkin and wax gourd were the main foods of subsistence.

The nutrition was enough for home convalescence therapy. This also played a large role in the treatment of diseases. Not particularly, Vitamin C and Vitamin B injections were given quite often. For high fever, Phenacetin was given. Also, the head of the patient was cooled with water. Sulfa drugs were of no use.

The gargling of Boric acid solution was recommended for stomatitis.

As for folk medicine, there was the use of extract of persimmon leaves, *Houttuynia cordata* Thunb, Adlay, Nandin, Aloevera, Perilla, Geranium nepalense Sweet. Some people said that drinking vinegar was useful. Was there any relation between that and the concentrations of hydrogen ions in the body fluid? Also, there were cases of hopelessly, severely ill patients who got better by drinking large amounts of Japanese sake.

(F) Medical materials

These medical materials were supplied by the city government : dressing, gauze, cotton ball, stitches, bandages, mercurochrome, limaon, Creosol soap solution, lysol, hydrogen peroxide, alcohol, sesame oil, antacids, phenacetin, sodium carbonate, boric acid, Vitamin C, Vitamin B, vitacampher, digitalis, narcopon, sodium citrate, acrinol, thrombogen, ephedrin, lard, etc.

CHAPTER 7

Future Prediction and Counter Measurement

SECTION 1

Question of habitability at the hypocenter

Questions needing answers

The question of habitability in the hypocenter area can not be decided until more research results are obtained. This was the first announcement by the creators of the atomic bomb. Therefore, we would like to know what materials were used, how the bomb exploded, and what was the result of the preliminary test? There is also the question if there was any residual radioactivity at the hypocenter, and if any still remains, is it possible to clean it up? How many times greater was the amount of residual radioactivity than our estimate? Also, what kinds of radioactive elements were there? How strong was their penetration power? How thick should protective devices be? These questions should be answered.

According to our estimates, there would be no problem if all the atoms of the atomic bomb had exploded immediately, but parts of the atoms did not undergo fission or they underwent fission incompletely and fell on the ground as radioactive mass. If the source of the atom was a light element, its length of radioactivity would be short, but uranium and thorium are heavy element substances. Their radioactive period by natural fission is very long.

For example, the radium of the series has a half-life of 2,000 years. We can't wait and do nothing. That half-life is not just 75 years as well. Therefore, we would honestly like to be informed the name of that element.

Counter measurement of radioactivity

Next, we need to use a sensitive detector to measure the precise amount of radioactivity at the hypocenter. The strength of radiation is the inverse square of its distance from the hypocenter. Therefore, in a wide area, if we just did spot checks, we could miss the radioactivity. You must take many small samples throughout the whole area, one by one, so that the radiation spots can be detected. Perhaps, these radiation spots are very small and cannot be seen by naked eyes. But, they can be taken out by a spoon. If we don't discard these, but collect and purify them, we may be able to recycle a large amount of radioactive substances, like radium.

If all matter in the hypocenter received powerful primary radiation at the time of the atomic bomb explosion, they would be endowed with radioactivity artificially, and still emit radiation. We have to measure how deep the ground is contaminated. The thickness of the contaminated

ground must be excavated in large scale. But if we wait, this radioactivity will disappear in a short time.

Because I did not perform any experiments, I cannot say all this with certainty, but if small animals like ants were not eliminated from the earth, there is nothing to worry about radiation close up. The ants of an atomic field are ones to be watched.

This is also a simple test method to detect radiation. Photographic film can be wrapped in black paper, left on the ground or underground for a week, and developed thereafter. If it's exposed, there is radiation. Anyway, although the place is livable, it is still better to have a thick floor. It would be safer to have lead plates beneath the floor. Also, it would be better to paint the floor with Barium like plaster and lay the tatami mat above it. A floor of more than 30 centimeters thick of concrete is good. Also, raise the floor higher, keep the distance from the ground greater is also one of the methods.

When glass receives radiation, it changes to purple or brown. If the glass panels in the house changes color in the future, the area will be known to have radioactivity.

What kind of disorders will develop if one lives under constant weak radiation? The prediction is leukemia, infertility, dry skin, etc. The white blood cells will decrease initially but increase later. This is the radiation induced chronic myelogenous leukemia. Its prognosis is not good. Infertility is mainly due to the destruction of reproductive cells. General secretary gland are damaged and one could have dry skin.

SECTION 2

Disorders developed in human bodies

Late onset disorders

A symptom that will appear in the near future is the lowering of immunity to fight bacteria causing pustulous abscesses and other microorganisms based on the decrease of white blood cells. Thus, the bite site of a wound as small as a mosquito or flea bite can easily become suppurative and will not heal easily. And combined with easily transmitted infectious diseases from unsanitary conditions in the hypocenter area, epidemics of all kinds of infectious disease are expected.

Of course, an increase in white blood cells will help one regain the resistance of the body at first. If we do not set up a community toilet, sanitary operations*, and the building of residential houses with gov-

Translator's Note : Sanitary operation refers to city sanitation workers re moving night soil or human waste each morning from residential areas. Usualy, the night soil was used for crop fertilizer. In Nagai's time, sewage and plumbing was not available in all areas in Japan.

ernment assistance immediately, the situation will soon be disastrous. The typical post war product, an infectious disease epidemic, is unnecessary, to be avoided, but now we have a new chapter added to the usual post-war story, the decreasing of white blood cells as a result of radiation. We have to take great precautions.

Also, we have to worry about kidney disorders. This disorder means one will have frequent urination at night. With the development of atrophic kidney edema, nephritis can be expected. Those people who receive strong radiation in the adrenal glands could develop abnormal pigmentation of the skin.

The regeneration of hair loss will happen, but perhaps it will take a long time. And it may be incomplete.

How about the growth of children? Bone growth will be impaired if they receive a large amount of radiation. The amount of bone growth is related to the amount of radiation it receives. Even a small amount of radiation will impair bone growth.

There were complaints of irregular menstruation and impotence, but these symptoms will recover gradually. Thus, infertility is not permanent.

Delayed onset disorders

Long term problems are delayed onset disorders. First is the generation of keloid or pseudo-burns. This is the low resistance part of the skin. If you scratch or give stimulation to them often, apply medication, or the injury will not heal easily. We have to worry if this type of pseudo-burn will become an ulcer. Therefore, keloids have to be watched carefully and protected. One must speak to the patients specifically about this precaution. This is the possibility of a malignant change from an ulcer to cancer after a long time.

The second is the matter of the hematopoietic (blood cell forming) system functional restoration. It is early October, two months after (the explosion) and new occurrences of blood disorder in-patients are rare. Patient symptoms have healed or are getting better, but is this the end?

In general, radiation disorders will appear in waves as primary, secondary, and tertiary stages. There was a case where a subcutaneous hemorrhagic spot appeared twice within a two-week interval. Thus, we worry that the patient will deteriorate after getting better temporarily. Also, there is the possibility of the transformation to a chronic blood disorder. These questions have to be determined periodically by blood tests of the resident people.

SECTION 3

Agricultural products

In an experiment, the growth of plants was enhanced by a very small

amount of radiation, disturbed by a large amount. Plants wither and die with a very large amount of radiation. If radioactivity remains in the hypocenter, the growth of agriculture products will be no good.

We think that the eating of agricultural products grown in the hypocenter should not be harmful. Once, the pumpkins of Urakami were said to be poisonous. They must have been blown up the blast, lying on the ground with the hot sun shining on them, and decomposed.

CHAPTER 8

Observations

SECTION 1

The bomb

Materials

The utilized elements were uranium and plutonium, both heavy elements. These are very difficult to get as raw materials. If the mechanism of the explosion had been changed, even lighter elements could be used, such as aluminum. The substance emitted from the bombs was thought to be atomic energy, electromagnetic waves and particle groups.

Radiation

Tactically, atomic energy aims for destruction, and heat rays for fire are required. The results were exactly as the scientists calculated in their minds. This was not a question of humanity (but destruction). There was nothing we could do as victims of war. This was war. We did not particularly resent it. However, later on, after the end of the war, as patients passed the latent period, particularly as the question of living with residual radioactivity appeared, we were drawn to think about humanity. Those by-products of radiation, electromagnetic waves and particle groups caused body disorders, which came to our attention.

From the beginning, the neutron, a part of the particle group, was taken seriously and even propagandized. But we think the gamma rays played the most important role.

Fallout

A part of the particle group emitted directly to the ground right after the explosion had a great effect on human bodies, but other parts lost their moving energy, floated into the air, were blown down by the wind, and had to come down gradually. These particles became residual radioactive substances later. We think that the main portion of the white cloud, which developed immediately after the bomb explosion, was these particles.

Flash

How bright was the flash? It must have been tremendous. People felt that the flash was even brighter than a magnesium gun going off on a bright, mid-summer day. People perceived different color complexions of the flash. The majority of people said it was "close to a white color." Also, there is a person who claimed to have seen seven colors like the rainbow. One said that the earth, lit up red in the flash, was as beautiful as the earth

illuminated in the light of a setting sun.

Were these differences in perception due to the difference of each person's optic nerve? Or was it due to inaccurate perceptions due to the sudden emergence of the flash? Were differences in the electromagnetic waves due to the different directions the flash went? For those who did not experience the flash directly, but only as diffused light, they were not blinded.

Explosion sound

Within one kilometer of the hypocenter, we did not hear the sound of the explosion. However, people far away heard a tremendous, large boom sound several to ten times as great as that of a usual bombing. Indeed, a few of us had our eardrums ruptured.

Blast pressure

The attack of blast pressure was not momentary. After a few seconds, we felt like we were in the middle of a tempest. At the beginning, it was relatively weak, about the level of a storm for a second, followed by an even more powerful blast, which lasted for about two seconds, then I think it quieted down.

The bombsite reflected the blast pressure off the mountainous slope. The site was attacked twice (by blast pressure) in each interval. This must have been related to the process of the atomic explosion. Look at the site of the explosion, the blast pressure moved downward from above, was reflected by the ground, and blew up again. It was as if the head was struck in one direction, then the legs were kicked out from the opposite direction. There was lots of evidence of horizontal movement just above the ground. Big stones moved horizontally just above the ground.

How strong was this power? Probably due to blast pressure, the people outdoors or in corridors inside lost their clothes in a moment.

Belted or tied portions or thick pleated skirts were left on, but other loose clothes were blown off. Some people found their own clothes blown off and torn up in the far away distance. Anyhow, at that moment, men and women, young or old, who had been dressed in various clothes in front of us, were suddenly naked. It was quite shocking, but we also felt it was little bit funny.

Cause of fire

There are several things to be considered for the cause of fire. It is said that the temperature at the time of atomic bomb explosion was higher than the sun's. Thus, within 500 meters, a short distance, even if it was just a moment, the heat had the power to burn up everything on the ground.

Even though the lumberyard was empty and there was no concern that it could catch on fire, the yard still burned up. The lumberyard must have simply burned up from the heat rays emitted by the bomb. Of course, if there were fires, most likely they came from heating devices that were

burning within the buildings before they collapsed. But if we look at the entire area of the hypocenter, we see that the fires did not start at the same time but from different ignition points scattered around. Why was that?

First, we think, the heat ray came at once and evenly. Its functional time was momentary and short; it could not ignite everything on the ground. Yet, black colored items easily absorbed heat. Also items with typically low combustibility yet next to more combustible items also caught on fire.

The next idea was that the distribution of heat rays was not even in some places. In some places, a large amount of heat rays were emitted and a fire ignited. This was due to the heat rays of long length electromagnetic waves. In another case, many people saw that a fireball fell down and ignited the fire. These phenomena were observed at the places far from the hypocenter.

The fireballs were not too big, many just the size of a finger tip. They came flying out at the same time of the blast pressure. Were these heated fragments (atomic mass) from the bomb itself? Or were they incendiary materials being spread at the same time?

Darkness

Why did we lose our vision immediately after the bombing? Most people thought the optic nerve function was lost temporarily due to the blinding flash. Our impression was different. It may have been that the thick dust of everything broken up on the ground. There was complete darkness. Was this due to primary radiation and secondary radiation built up on the ground, which formed a special gas in the air? Or, was it that the sunlight was completely shut down by the thick gaseous cloud in the air? The last thought was the most logical because one or two minutes later, the clouds moved out and the bright sun shone again. At the moment of darkness, many people thought they had become blind.

Difference between the gunpowder bomb and the atomic bomb

We think the difference between the atomic bomb and gunpowder bomb is as follows :

Difference between the two types of bomb		
	Atomic bomb	Gunpowder bomb
Mechanism of explosion	Physical	Chemical
Main Part	Atomic nucleus	Extranuclear electron
Product	Particle group, electromagnetic wave, atomic energy	Gas, heat, fragment
Power	Enormous	Small
Amount of material	Small	Large
Function	Mechanical (destruction) Physical (radiation)	Mechanical (destruction)
Duration of function	Continuous, decaying	Momentary
Human body injury	Blast wound, external wound, radiation disorder, burns	Blast wound, external wound (fragmental wounds)
Time of disorder onset	Instant onset, late onset,	Instant onset
Prediction of prognosis	Difficult	Easy
Complication	Yes	None
Radiation sickness	Yes	None

In the future, we in the medical profession can distinguish the injuries from an atomic bomb if a small atomic bomb is used. Thus, the atomic bomb causes many burns whereas the gunpowder bomb causes fragment wounds. This difference is important to note because in the case of the atomic bomb, the people at the site require rest and convalescence in consideration of late onset disorders.

SECTION 2

Human body injuries

Classification of symptoms

The radiation disorders in this chapter were based on cases of whole body irradiation. There was a primary and large amount of momentary irradiation and secondary small amounts of repeat irradiation. All organs received injuries. The radiation had some differences in severity. Symptoms of the digestive system and hematopoietic system appeared markedly, but this was not because these organs received especially large doses of irradiation. The tissue of these organs had different sensitivities to radiation.

Latent periods were different. Reactions of the tissue to radiation