WAR DIARY

of the

U.S.S. HAVEN (AH-12)

for the period:

0000, 1 September 1945

to

2400, 30 September 1945

CONFIDENTIAL

U.S.S. HAVEN (AH-12) operating under Commander Fifth Fleet, Admiral R. A. Spruance, USN; Commander Task Force 55, Rear Admiral M. L. Deyo, USN; Commander Task Group 55.7, Rear Admiral F. G. Fahrion, USN.

The period 1 September 1945 to 10 September 1945 was spent at anchor in Buckner Bay, Okinawa Shima, Ryukyus Islands, awaiting orders.

At 0600, 10 September 1945, this ship got underway for Nagasaki, Japan as a unit of Task Group 55.7, Rear Admiral F. G. Fahrion, USN, Commander Task Group 55.7, in the U.S.S. WICHITA. This ship in column 1200 yards astern of U.S.S. WICHITA, U.S.S. MUGFORD (DD-389), U.S.S. WEBBER (APD-75), U.S.S. GREENE (APD-36) and U.S.S. GILMER (APD-11) screening U.S.S. HAVEN and U.S.S. WICHITA, enroute to evacuate prisoners of war from the Island of Kyushu.

Zone: minus 9 time

Positions.
0800 26° 29' N - 128° 13' E
1200 27° 21' N - 128° 04' E
2000 29° 21' N - 128° 32' 30" E

At daylight, 11 September 1945, a mine was sighted, and this task group reduced speed and proceeded with caution. Two more mines were sighted, and at 0800 this task group lay to awaiting the arrival of the local mine sweeping group in Latitude 32° 19' N, 129° 20.5' E.

At 1200, with the arrival of the mine sweeping group, this task group got underway, mine sweepers in the van, and proceeded to Nagasaki Harbor, Kyushu, Japan. An American naval officer from one of the mine sweepers boarded the U.S.S. WICHITA to pilot her into Nagasaki. Other ships in the task group formed astern of the U.S.S. WICHITA and proceeded into Nagasaki in her wake.

Japanese pilots were supposed to have been available for the task group upon arrival. However, the Japanese Port Director at Nagasaki stated that the task group was not expected until 12 September 1945, and for that reason no arrangements had been made for pilots.

Ships in the task group moored to buoys in the stream without incident. The U.S.S. HAVEN moored alongside Dejima Pier, Nagasaki, Japan at 1645 and secured her main engines.

The attitude of the local Japanese authorities was one of complete cooperation, but all possible precautions against treachery were taken. It is to be born in mind that no occupation troops had landed in Nagasaki at this time, and Task Group 55.7 was a small force in a completely land locked harbor.

Immediately upon arrival, this ship's medical department began work setting up a sick bay on the dock in order that ex-prisoners of war might be showered, deloused, and dressed in clean clothes prior to their embarking on

ships. This was not a small undertaking, because the explosion of the atomic bomb had had its effect on all buildings near the Dejima Dock area. However, a building alongside the dock was selected as a sick bay. Electrical power was furnished by the U.S.S. HAVEN. The U.S.S. WICHITA set up showers, and arrangements were made with local Japanese authorities for working parties to clean up the area around the dock.

At 1900, the first ex-prisoner of war was admitted to the U.S.S. HAVEN's Hospital from the Japanese Army Hospital at Nagasaki. Three other ex-prisoners of war, a Dutchman, an Englishman and an American, had been able to get to the U.S.S. HAVEN from Fukuoka #2, Japanese Prison Camp, and were admitted to the Hospital.

12 September

Zone: minus 9 time

This day was spent in cleaning up the dock area, and putting the sick bay on the dock in readiness to handle ex-prisoners of war.

13 September - 24 September 1945

Zone: minus 9 time

The first group of ex-prisoners of war were received on 13 September 1945. The U.S.S. HAVEN remained at Nagasaki until 25 September 1945, at which time all ex-prisoners of war had been evacuated.

Enclosure (A) is a detailed report on the medical aspects of the operation and is submitted herewith. Enclosure (B) deals with the effect of the injuries sustained by humans from the atomic bomb. On 24 September 1945, occupation troops began to arrive.

25 September 1945

Zone: minus 9 time

At 0813, this ship got underway for Buckner Bay, Okinawa Shima, in accordance with Commander Task Group 55.7 Dispatch 241415, with Task Unit 55.7.60, Captain T. T. Patterson, USN(Ret.), Commander Task Unit 55.7.60, Commanding Officer, U.S.S. HAVEN; U.S.S. TATUM (APD-81), U.S.S. WEBER (APD-75), and U.S.S. GILMER (APD-11) comprised the remainder of the task unit. The U.S.S. HAVEN had patients on board, ex-prisoners of war being taken to Okinawa as the first step toward their repatriation.

Positions.
1200 32° 03' N - 129° 20' E
2000 29° 55.5' N - 128° 35' E

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26 September 1945

Zone: minus 9 time

At 1340 the U.S.S. HAVEN dropped anchor in Buckner Bay, Okinawa Shima. Task Unit 55.7.60 was dissolved.

Position.
0800 26° 57.5' N - 128° 22.4' E

27 September 1945

Zone: Minus 9 time

At 1430, 453 patients received at Nagasaki, Kyushu, Japan, were transferred to U. S. Army Ramp Evacuation Facilities, Okinawa, Shima.

28 September - 30 September 1945

Zone: minus 9 time.

Warnings received indicated that a typhoon was headed for Buckner Bay. In accordance with orders of the Senior Officer Present Afloat, all large ships put to sea. At 1430 the U.S.S. HAVEN got underway and took her station as fifth ship in the second column. Winds of 30 - 35 knots were encountered, but the typhoon was completely avoided.

Positions.

28 September 1945
2000 25° 56' N - 128° 00' E

29 September 1945
0800 25° 45' N - 126° 41' E
1200 25° 45' N - 126° 02' E
2000 26° 42' N - 125° 28' E

30 September 1945
0800 26° 32' N - 124° 58' E
1200 26° 32' N - 125° 23.5' E
2000 26° 03' N - 126° 25' E

T. T. PATTERSON
Captain, USN(Retired)
Commanding

ENCLOSURE (A)

MEDICAL ASPECTS OF JAPANESE PRISON CAMPS AND PRISONER-OF-WAR EVACUATIONS.

The facts which form the basis of this report were obtained by medical officers of the U.S. Navy Hospital Ship "Haven" in visits to the camps, in the course of processing and screening 9043 prisoners of war, and from the observation of those 888 of them who were admitted to the hospital ship for treatment and study. The U.S.S. Haven arrived at Nagasaki Harbor, Japan, (Island of Kyushu) on 11 Sep't., 1945. Its mission was to process and screen, medically, allied prisoners of war, to expedite the hospitalization of those urgently in need of hospital care; to select for temporary hospital study or treatment those cases which required diagnostic work-up or supportive and corrective therapy before qualifying for further evacuation by transport ship; and to screen out those who were free from infection and contagious disease, and were well enough to be evacuated immediately by ordinary transport.

A preliminary survey made by the rescue teams of the 6th Army had disclosed approximately 10,000 allied prisoners of war on the island of Kyushu in Southwestern Japan. There were twenty five camps scattered about the island, all designated Fukuoka #___. Representatives of the United States and Allied Armies had already determined the military status of these men and were prepared to evacuate them to Nagasaki upon word from the Navy that the physical and personnel set up for the medical processing and screening had been completed.

While the Haven was enroute to Nagasaki a Board of its Medical officers had elaborated a plan for the use of a railroad siding and buildings on the dock for the reception and screening of evacuees, and established the number and type of personnel, both medical and non-medical, necessary to effect a smooth and expeditious processing and screening. Arrangements were made with an accompanying cruiser to pre-fabricate two sets of shower lines so that the work could begin with a minimum of delay. The Supply Department made all arrangements for the proper clothing and feeding of the evacuees. Fortunately the railroad siding, dock area, and buildings pre-selected were sufficiently undamaged to be suitable for the project. However a tremendous amount of clearing away of debris and of rotting, stored grain was necessary as was also a spraying of the area with DDT powder before carpenters and plumbers were able to set up the showers and other required spaces. The ordinary labor was done by Japanese labor groups under the supervision of the Army; the technical work was done by rated men from the U.S. Navy ships. The "Haven" was docked alongside the selected area and a steam line was connected from the ship to the shower pipes to furnish warm water. The Nagasaki water facilities on the dock were found to be intact and adequate, and preliminary testing indicated the suitability of the water for shower purposes. Word was given to the Army and Allied representatives that processing could begin at 0800 on 13 Sept. (1½ days after our arrival) and the first train arrived at that time as per schedule.

Selected medical personnel from the U.S.S. Haven were sent to the various camps to study camp conditions as they influenced health, and to designate those cases requiring urgent hospitalization and early evacuation. The plan was to evacuate approximately 1,000 men per day, in three train loads, to arrive at 0800, 1200, and 1530. All stretcher cases were to be placed on cots in a coach set aside for that purpose.

Upon arrival at Nagasaki obvious stretcher cases were carried from the train by stretcher teams of hospital corpsmen, taken into an adjacent building, divested of their clothing, sprayed and dusted thoroughly with DDT after being given a "bed-bath", and routed directly to a designated bed on the hospital ship by a routing Medical Officer. No attempt was made to interrogate or shower these patients before admission. All other prisoners of war were directed along a one-way maze which led them respectively past (a) tables at which Nurse Officers from the "Haven" obtained general health data on a mimeographed form (Fig. #1); (b) an enclosed undressing area where clothes were discarded or, if desired, were put in a sea-bag, tagged, sprayed with DDT; (c) shower lines where water and soap were plentiful; (d) a de-lousing area where the patient was thoroughly dusted with DDT by a team of hospital corpsmen; (e) a medical screening area where, with the aid of the preliminary questionnaire filled out by the Nurse Officers, the P.O.W. was inspected and examined by Medical Officers; (f) the clothes reclaiming and new-issue area manned by members of the Supply Department; and (g) the final dressing area where the P.O.W. donned fresh clothing before being directed to waiting transport ships.

Figure # 1

P.O.W. GENERAL STATISTICS

Name: . . . . . Nationality:. . . . . .

Date Captured:. . . . . .

FOOD: (Insufficient), (Bad), (Fair), (Good), (Insufficient).

Fever, Chills: (Yes) (No)

Dental Trouble: (Yes) (No)

Lice: (Yes) (No)

Dysentery: (Yes) (No)

Swelling of hands or feet: (Yes) (No)

Skin Trouble: (Yes) (No)

Loss of Weight:. . . . . lbs.

Cough: (Yes) (No)

Blood Spitting: (Yes) (No)

REMARKS:

In the medical screening special attention was directed to presumptive evidence of tuberculosis, active infection, severe nutritional deficiency disorders, recent or active diarrheal disease, especially if accompanied by blood or mucus in the stools, and the presence of obvious contagious disease. Particular attention was directed to nutritional edema or wet Beri Beri. Upon evidence of any of the foregoing, the P.O.W. was directed to a routing Medical Officer, then given slippers, pajamas, and bath-robe, and tagged for a designated bed aboard the ship, to which he was led by a hospital corpsman.

In the period Sep't 13 - 22 inclusive, 9043 P.O.W.'s were processed and screened. Of this number 888 were admitted to the hospital ship for treatment and study. The statistical analysis which follows will be separated into two parts; (a) the entire group and (b) the cases admitted for hospital study. (7272 questionnaires were sufficiently complete to admit of analytical study and the figures and percentages quoted in part (A) are based on that total).

(A). Analysis of Entire Group.

Total number of processed 9043.
Average per day 904.

Comment: The staggering of the arrival at Nagasaki at three periods during the day made it possible to conduct an orderly processing. A tracer study of 200 consecutive cases indicated that it required from 12 to 20 minutes to complete an individual processing from the time that the P.O.W. stepped before the Nurse Officer's table to fill out the preliminary health questionnaire to the time that the medical examination was completed. The line moved steadily and without confusion. The lowest number of cases in any one day was 639, the largest 1369.

Nationality.

Americans	1101	(15.1%)	(based on 7272 analysed)
British	2796	(38.4%)	
Australian	412	(5.6%)	
Dutch	2916	(40.1%)	
Others	43	(0.8%)	

Comment: Dutch and British P.O.W.'s constituted the majority. Included among the British was a small number of Indians (British Sovreignty), and among the Dutch, Hollanders and Dutch East Indians (Javanese) were about equally divided. In the miscellaneous group there were 27 Chinese, 9 Portugese Indians, 4 Norwegians, 2 Czechoslovakians, and 1 Malayan.

Dental Trouble.

3612 (49.6%)

Comment: This figure is probably much too low. Many of the P.O.W.'s revealed evidence of neglect and decay despite the statement that their teeth had given them no trouble. The teeth of the Javanese Dutch were strikingly better than those of their white compatriots. In view of the restricted nature of the diet this incidence is not unusual.

Dysentery.

2196 (30.2%)

Comment: This figure represents those individuals who experienced episodes of frequent, loose, watery stools, usually accompanied by mucus, blood, or pus, and lasting two or more weeks. Obviously many of these diarrheas were on the basis of vitamin deficiency. However a great number of individuals with amebic dysentery will not have been included because of the mildness of the symptoms.

Skin Trouble

2173 (29.8%)

Comment: Under this heading are grouped scabies, miliaria, pyogenic dermatitis, severe fungus infection, and furunculosis. Trophic changes due to vitamin deficiency were common. Advanced pellagrous changes were strikingly infrequent but early skin changes of Pellagra were not uncommon. One case of Lepromatous (nodular) Leprosy was encountered in a Dutch Javanese.

Cough	2105	(28.9%)
Hemoptysis	237	(3.2%)

Comment: Only those cases with cough lasting longer than three weeks were recorded to rule out those due to transient acute respiratory infection. The majority of the cough were due to asthma, chronic bronchitis, or to prolonged irritation from the dust of the mines in which many of the P.O.W.'s worked. Slightly more than 10% of these with persistent cough had hemoptysis which, in many instances, was an indication of pulmonary tuberculosis. Considering the hard work, inadequate clothing, and excessive weight losses, it is remarkable that the incidence of cough and hemoptysis was not greater.

Fever and Chills.

3655 (50.2%)

Comment: These are patients with febrile disease of more than a few days duration, or with recurrent fever and chills of the type seen in malaria. Many of these undoubtedly suffered from malaria and a good percentage indicated that they had contracted malaria while P.O.W. in the Phillipines or in Burma. Many had contracted pneumonia in the winter of 1943, in Japan, when the winter was cold, and clothing and housing facilities were woefully inadequate. Persistent and unexplained fevers were also common. In many instances they were undoubtedly due to endemic typhus fever (see hospital statistics)

Lice.

4701 (64.6%)

Comment: This figure is undoubtedly lower than the true incidence. It indicates, however, the unsanitary living conditions under which the P.O.W.'s existed and also the opportunity for the louse-borne infections.

Edema.

3106 (42.7%)

Comment: This figure is also lower than the true incidence of edema. Many of the P.O.W.'s who disclaimed ever having any swelling were actually edematous at the time of the interrogation. Usually limited to the feet, ankles, and lower legs, it was not infrequently universal, of the type seen in acute nephritis, or nephrotic edema. In most instances this edema was due to beriberi of the wet type. Some of it was undoubtedly due to hypo-proteinemia from prolonged inadequate protein intake. Many of the P.O.W.'s exhibited edema, (and then usually to a conspicuous degree) for the first time after eating excessively of the rations dropped down by our planes after August 15th. The reason for this phenomenon has not yet been established. Many developed an acute gastro-enteritis following the excessive food intake and may therefore have accentuated their B1 deficiency, with resultant further disturbance of water balance. In most instances, however, the accompanying temporary sharp increase in salt ingestion at a time when water balance was poor, probably accounted for the fluid retention. The tense abdomens, full of ascitic fluid, standing out in sharp contrast to the thin chests were conspicuous in the processing line.

Weight Loss

None	346	4.8%
1 - 10 lbs.	484	6.7%
11 - 20 lbs.	1512	20.8%
21 - 30 lbs.	1557	21.5%
31 - 40 lbs.	1252	17.2%
41 - 50 lbs.	1123	15.5%
51 plus	988	13.5%

Comment: Marked weight loss was to be expected. It is interesting to note that most of those who reported little or no weight loss were in the Dutch Javanese group. These individuals are normally adapted to a rice diet and fared much better than the other groups. Approximately 75% of the entire group had weight loss of from 11 to 50 pounds, and 15.5% showed weight loss of more than 50 pounds. There were many instances of loss of 80 to 100 pounds and these men were literally, as well as figuratively, little more than skin and bones.

ANALYSIS OF PATIENTS ADMITTED FOR HOSPITAL STUDY

Eight hundred and eighty eight (888) evacuees were admitted to the U.S.S. Haven during the period Sept. 13 - 22, inclusive. These include 15 women, all but five of whom were nuns. These five were wives of missionaires and were accompanied by their husbands. With the exception of one woman who was suffering from malnutrition and cardiac failure, all were accepted as passengers and not as patients. These 20, together with 151 others in whom the hospital data were incomplete because of too short a period of observation are excluded, leaving 717 cases as the basis of the following statistical analysis. The analysis of this group is deivided into two parts: I. Data obtained on questioning of prisoners-of-war after admission to the hospital ship and II, physical and technical findings after examination.

I. DATA OBTAINED ON QUESTIONING OF PRISONERS OF WAR AFTER ADMISSION TO THE HOSPITAL SHIP (U.S.S. HAVEN).

AGE

Ages.	21 - 25	144 patients	(20.1%)	Total 717
Ages.	26 - 30	234 "	(32.6%)	
Ages.	31 - 35	168 "	(23.5%)	
Ages.	36 - 40	93 "	(13.0%)	
Ages.	41 - 50	63 "	(8.7%)	
Ages.	51 - 50	12 "	(1.7%)	
Ages.	61 plus	3 "	(0.4%)	

Comment: 75% of the entire group were between 21 and 35 years of age, as would be expected of a military group. This age incidence is of significance in considering the morbidity in prisoner-of-war camps as contrasted with that in military personnel in similar age groups:

NATIONALITY

American	184 patients	(25.6%)	Total 717
British	256 "	(35.8%)	
Australian	84 "	(11.7%)	
Dutch	188 "	(26.2%)	
Others	5 "	(0.7%)	

Comment: Americans comprise 25.6% of the group. Included among the British are 9 Hindus (Indians of British Sovreignty), in whom there was a high relative incidence of pulmonary tuberculosis. The Dutch consisted of approximately two thirds Indonesions (Javanese) and one-third Hollanders, or white Dutch. It is worthy of comment at this point that the prisoner dietary was well tolerated by the Javanese who, as a group, were least affected by nutritional and deficiency disorders. Rice, which formed the bulk of the prisoner dietary is the normal basic foodstuff for the Javanese.

RESIDENCE AT TIME TAKEN PRISONER OF WAR

Philippines	129
Wake Island	24
Guam	2
At Sea	70
Singapore	211
Java	250
Timor	14
Malaya	3
China	4
Not recorded	10

Comment: These figures are of interest because of exposure to disease prior to internment in prisoner-of-war camps in Japan. Malaria and dysentery were rife among the Americans in the Philippine camps, and among the British and Dutch in Burma and Thailand. Little effort was made to protect the prisoners-of-war from these diseases.

NUMBER OF CAMPS OCCUPIED BY EACH PRISONER OF WAR

12 patients	one camp
153 patients	two camps
214 patients	three camps
120 patients	four camps
90 patients	five camps
128 patients	six or more camps.

Comment: These figures are of interest chiefly because of variation in sanitary, dietary, and working conditions in different camps. Travel from one camp to another usually was difficult and, in itself, indicated a considerable additional health hazard. Malaria, and particularly the dysenteries were proportionately greater among prisoners who had been interned in 3 or more camps.

TOTAL DURATION OF CONFINEMENT AS PRISONER-OF-WAR

2 - 3 years	16 patients
3 or more years	701 patients.

Comment: None necessary other than to indicate the long duration of confinement among those hospitalized.

DURATION OF CONFINEMENT IN SOUTHWESTERN JAPAN (KYUSHU)

Under 6 months	23 patients
6 - 12 months	114 patients
1 - 2 years	274 patients
2 - 3 years	237 patients
3 or more years	66 patients
Not recorded	3 patients

Comment: 577 patients were prisoners-of-war in camps on Kyushu for from 1 to 3 years. These figures are of importance in considering the morbidity because they indicate either the inception of the disease (or diseases) or inadequate Medical care in Japan proper. Interrogation of prisoners indicates that quinine, though plentiful early in the war was dispensed in inadequate amounts and this holds true for the sulfa drugs and other drugs which the Red Cross had made available in adequate quantity.

DISEASES ACQUIRED IN PRISONER-OF-WAR CAMPS

Beriberi (all Forms)	470 patients	(65.5%)
Dysentery (all Forms)	417 patients	(58.1%)
Malaria	307 patients	(42.5%)
Skin disorders	144 patients	(20.1%)
Pneumonia	139 patients	(19.3%)
Pellagra	98 patients	(13.6%)
Malnutrition	68 patients	
Bronchitis	66 patients	
Dengue	59 patients	
Pleurisy	50 patients	
Fever-unknown origin	43 patients	
Tuberculosis	40 patients	
Fractures (all types)	28 patients	
Jaundice	28 patients	
Scurvy	23 patients	
Visual disturbance	23 patients	
Dyphtheria	14 patients	
Asthma	14 patients	
Rheumatism	13 patients	
Ear Trouble	12 patients	
Kidney Trouble	12 patients	
Burns	10 patients	
Hemorrhoids	8 patients	

Appendicitis	7 patients
Typhus Fever	4 patients
Heart Trouble	4 patients
Hernia	3 patients
Diabetes	2 patients
Osteomyelitis	2 patients
Frost-bite	2 patients
Lumbago	1 patient
Varicocoele	1 patient
Small-pox	1 patient
Leprosy	1 patient
Bursitis	1 patient
Spontaneous pneumothorax	1 patient
Acute cold	1 patient
Gangrene	1 patient
Hookworm	1 patient

Comment: The diseases listed above are necessarily incomplete because they represent only the patients knowledge or awareness of an existing disorder. Obviously generalized avitaminoses were masked by the more conspicuous symptoms and signs of beriberi and pellagra. Malnutrition as such was infrequently complained of as the sole disorder, and the figure 68 above indicates those whose only complaint was weakness and debility from starvation and weight loss. Actually malnutrition in some form was present in over 90% of the cases.

Beriberi (470 patients - or 65.5%) was the most frequent disorder complained of, and its symptoms and signs were sufficiently well-known to indicate that the figure 65.5% is very close to the actual incidence of the disorder among the prisoners-of-war. In most instances, dry beriberi, as charcterized by burning, numbness, tingling and later weakness of the extensor muscles of the legs and thighs, preceded the appearance of the wet (edematous) form of beriberi. In some camps, as might be expected from the variations in diet, the incidence of beriberi was higher than in others. It is noteworthy that beriberi was much less frequent, in the Javanese who normally subsist chiefly upon rice. Dysentery (417 patients or 58.1%) was frequent, as might be expected under the unsanitary conditions of camp life. Since this figure includes all severe diarrheas of several weeks or more duration, some of it probably represents deficiency diarrheas.

Malaria (307 patients or 42.5%) was usually contracted outside of Japan chiefly in the Philippines and in Burma and Thailand. Quinine was apparently given in inadequate amounts despite Japanese control of the source of quinine supply.

Respiratory disorders were frequent, as might be expected, asthma (14 patients), bronchitis (66 patients), pneumonia (139 patients), pleurisy (50 patients) and tuberculosis (40 patients). The low incidence of asthma (14) is unusual for the tropical and subtropical countries. Tuberculosis, while frequent, and of much higher incidence than seen in a comparable military age group, is seen to be astonishingly low when one considers the unsanitary and crowded living and working conditions, hard work, inadequate diet, marked malnutrition, and the Japanese custom of not segregating or isolating cases of active tuberculosis so long as the individual was capable of performing any work.

Skin disorders, consisting of fungus infections, pyogenic dermatitis, furuncles, abcesses, and one case of leprosy, were frequent (144 patients) as might be expected.

Unexplained fevers, many of them recurrent over a long period of time were more frequent than the figures indicate. These represented tuberculosis malaria, infectious hepatitis (28 cases of jaundice), and presumably typhus fever.

Worm infestation was rarely complained of despite its significant incidence. Two prisoners-of-war knew of the presence of such infestation, one complained of hookworm, the other of taeniasis.

II. PHYSIC L AND TECHNIC L FINDINGS AFTER ADMISSION TO HOSPITAL SHIP

WEIGHT LOSS

No record	43	patients	6%	Total 717
1 - 10 lbs	105	"	14.8%	
11 - 20 lbs	120	"	16.7%	
21 - 30 lbs	151	"	21.0%	
31 - 40 lbs	105	"	14.8%	
41 - 50 lbs	85	"	11.8%	
51 - 75 lbs	92	"	12.7%	
76 or more lbs	16	"	2.2%	

Comment: Weight loss was determined by weighing the patient on admission and comparing with known weight at the time the patient was made a prisoner-of-war. It must be remembered that admission weights were from five to 30 pounds higher than they had been prior to August 15, 1945. On and after that date, food and vitamin rations in abundance were dropped by parachute from our airplanes, and practically all patients made remarkable weight gains in the short period between the dropping of food and admission to the hospital ship. It is seen that 62.5% of the patients had weight loss of more than 20 lbs, and that 26.7% had lost more than 40 lbs. The highest recorded weight loss was 110 lbs - and loss of 80 - 90 lbs was not unusual. Since loss of 10-20 lbs was not uncommon after diuresis in the wet beriberi group, it may be seen that marked weight loss was the rule in the entire hospitalized group.

EVIDENCE OF DISEASE (PRIMARY CAUSE FOR HOSPITAL ADMISSION)

Beriberi	Total 248 patients	(wet type 213, dry type 35)
Malnutrition and Debility	89 patients	
Pulmonary Tuberculosis	28 patients	(positive X-ray positive sputum)
Pulmonary Tuberculosis	32 patients	(positive X-ray negative sputum)
Pleurisy with effusion (primary)	13 patients.	
Amebic Dysentery	15 patients	
Infective Jaundice	9 patients	
Atypical pneumonia	19 patients	
Bronchitis (chronic)	29 patients	
Asthma	14 patients	
Scabies	16 patients	
Typhus fever (proven)	2 patients	
Fever unknown origin	10 patients	
Arthritis	6 patients	
Osteomyelitis	5 patients	
Fracture (all types)	25 patients	
Amputations	4 patients	
Malaria (P. vivax)	10 patients	
Acute Catarrhal Fever	4 patients	
Pyogenic Dermatitis (marked)		
Furunculosis - Carbuncles		
Burns	12 patients	
Otitis (media and externa)	9 patients	
Wounds and lacerations	6 patients	
Ureteral calculus	2 patients	
Perinephritis Abscess	1 patient	
Subacute nephritis	1 patient	
Thrombophlebitis (legs & thighs)	3 patients	
Recent appendectomy	2 patients	
Hypertension	1 patient	
Spontaneous pneumothorax	1 patient	
Penile lesion (cause &)	1 patient	
Leprosy	1 patient	
Epididymitis	2 patients	
Acute gastro-enteritis	2 patients	
Corneal Ulcer	3 patients	
Diarrhea (other than amebic)	4 patients	
Not classified	47 patients	

Where there is marked reduction of total serum proteins to 3-4 grams (normal 6-8 grams), or specific decrease of serum albumin, or alteration of the albumin-globulin ratio, the diagnosis of "nutritional edema is proper. Serum albumin, and albumin-globulin ratios could not be studied in this group because of lack of time, but hemoglobin, hematocrit, and total serum protein was done by the copper sulphate specific gravity method. Serum chlorides also, unfortunately could not be done. Anemia is recognized as a cause, per se, of water retention, and it has been shown that fluid retention after intake of salt is inversely proportional to the hemoglobin level. In 167 cases of wet beriberi (as listed in tables I, II, and III) it is seen that in only 1 patient was the total serum protein below 4 grams per cent. However, anemia as indicated by the low hemoglobin levels, was present in moderate to striking degree in the majority of the cases and may have been an important factor in the causation of the edema. It is interesting to comment in this connection upon the sudden massive appearance (or reappearance) of edema in many patients when the food ratio was suddenly increased after Aug. 15th 1945 by food dropped down by parachute from our airplanes. Water balance was so impaired as a result of vitamin B1 deficiency, anemia, and other causes, that the increased intake of food and salt, resulted in the quick accumulations of massive edema.

TABLE I. HEMATOCRIT (167 cases of edema)

20 - 25	4 patients	31 - 39	77 patients
26 - 30	13 patients	40 - 48	59 patients

49 plus - 2 patients (Normal 40 - 48)

TABLE II. HEMOGLOBIN (167 cases of edema)

6 - 8 grams	3 patients
8 - 10 grams	8 patients
10 - 12 grams	42 patients
12 - 14 grams	67 patients
14 - 15 grams	29 patients
16 plus grams	9 patients

TABLE III. TOTAL SERUM PROTEINS. (167 cases of edema)

(Normal 6 - 8 grams)

3 - 3.9 grams	1 patient
4 - 4.9 grams	3 patients
5 - 5.9 grams	16 patients
6 - 6.9 grams	41 patients
7 - 7.9 grams	97 patients
8 plus grams	9 patients

Some investigators claim that the edema of beriberi is due entirely to right ventricular failure, and the cardiac manifestations of beriberi are too well known to warrant detailed comment in this report. Cardiac dilatation, tachycardia, dypsnea, feeble heart sounds, dependent edema, chronic passive congestion of the viscera, electrocardiographic changes consisting chiefly of lowered amplitude of QRS and T waves, and prolongation of the Q-T interval, are prominent features of beriberi heart disease. In this hospitalized group twenty five electrocardiographic tracings were taken as on equal number of selected cases. Tachycardia (over 100/min) was the outstanding finding. Only minor changes in amplitude of QRS and T were noted.

One death in this group was directly attributable to beriberi heart disease. Typically, it was characterized by the sudden onset of severe dyspnea, cyanosis, and acute pulmonary edema. It occurred 3 hours after admission in a markedly edematous middle-aged British Army sergeant. He had eaten excessively prior to entrainment for Nagasaki and was resting quietly in bed when acute cardiac failure supervened. Although rallying temporarily to intravenous thiamin chloride (100 mg.), oxygen, morphine and atropine, caffeine, intravenous 50% glucose solution, and venesection (1000 cc) he died 18 hours after the onset of acute cardiac failure. Autopsy revealed dilation of all the cardiac chambers, more marked on the right, conspicuous pulmonary edema, chronic and acute passive congestion of the viscera, bilateral hydro thorax (more than 1000 cc in each pleural cavity), generalized subcutaneous edema, moderate ascites, some

Comment: The above figures represent the primary cause for hospital admission. Where more than one disease or disorder was present, the secondary disorder is not included in the above figures. These are listed separately below. For example beriberi was encountered in 326 instances, but only in 248 patients was it sufficiently severe to warrant hospital admission solely because of its presence. When secondary, it was more often of the dry (polyneuritic) type and was encountered most frequently in association with the malnutrition and debility, and with the diarrhea groups. A separate analysis of the beriberi group is listed and commented upon in a later section.

In 89 instances malnutrition and debility was so striking as to warrant hospital admission for further investigation and treatment. Actually more than this number were admitted for that reason, but those patients in this group who later revealed positive or suggestive evidence of pulmonary tuberculosis are excluded.

Tuberculosis, with both positive X-ray findings and positive sputa was encountered in 28 patients. In 32 other patients the X-ray suggested its presence but the sputum was negative for tubercle bacilli. There were 13 instances of pleural effusion - at least 4 of which may be presumed to be tuberculosis in origin. The other 9 possibly represented effusions on the basis of the wet form of beriberi. In the X-ray and sputum positive cases of tuberculosis, the picture was usually that of extensive and advanced infiltration with cavitation. Two of these patients died within 2 weeks of admission and post mortem examination revealed extensive bilateral involvement, with cavitation, involvement of the tracheo bronchial nodes, and tuberculous pericarditis.

69 patients were admitted because of non-tuberculous respiratory infections. Of these, 4 suffered from acute catarrhal fever (acute upper respiratory disease), and 19 from an atypical type of pneumonia. Chronic bronchitis was present in 29 patients, and true bronchial asthma was encountered in only 14 patients. (astonishingly low incidence in this climate)

22 patients were admitted because of persistent or recurring fever and of these 10 were due to malaria (p. vivax). Two (2) of this group showed serum agglutination with proteus ox19 in dilutions of 1-5120, therefore representing typhus fever (not the scrub type). In 10 instances the cause of the fever was indeterminate.

In 50 instances skin disorders were of sufficient magnitude to warrant admission. These were cases of carbuncle, furunculosis, pyogenic dermatitis, and scabies. Sixteen cases of scabies were admitted the first day, but it became quickly apparent that its incidence was so great that hospitalization for therapy was inadvisable. Accordingly other cases encountered were given a spraying with DDT in acetone and alcohol and not admitted to the hospital ship. One case of lepromatous leprosy was encountered and admitted for isolation.

Infectious jaundice was encountered in 9 instances, and in one case was protracted and severe (icterus index of 210). Whether these cases represent hepatitis due to a bacterial agent or whether it is due to a nutritional or vitamin deficiency is a matter of controversy.

Burns, 12 in number were extensive and usually of the flash type - mostly 2nd degree. In one instance the burns were very extensive about the face and back and were accompanied by serious blood protein changes. Nine of these were due to the atomic bomb, and are described in detail in a separate paper.

The remainder of the cases require no special comment.

BERIBERI

326 patients presented evidence of beriberi. In 248 instances it was either the sole or predominant cause for hospitalization. Of this number 213 were predominately of the wet type and 35 of the dry type. The wet form is qualified because, upon subsidence of the edema residual evidence of peripheral neuritis in the lower extremeties was not uncommon. The designation "beriberi", wet form, as applied to all of these cases may be properly questioned. Edema, associated with evidence of malnutrition usually suggests the diagnosis of "nutritional edema". Even in the presence of other signs of beriberi or some other well-known food deficiency there is a high probability that protein deficiency may be a factor as well as in those cases showing edema alone.

some pleural adhesions on the left, and an adult round worm (ascaris lumbricoides) in the small intestine. The stomach was distended with undigested food.

Treatment of the wet beriberi group consisted of bed rest, frequent small feedings of a high protein, high carbohydrate diet, multiple vitamins by mouth, supplemented by thiamin chloride mgm V t.i.d. by mouth and 50 mgm intramuscularly daily. In several instances, where dyspnea was striking, 100 mgms of thiamin chloride were given intravenously. In most instances there was prompt, usually dramatic, improvement. Diuresis with weight loss of 5 - 25 pounds became evident within 36 - 72 hours following admission, and edema correspondingly, quickly disappeared. Only in several instances when generalized edema, accompanied by evidence of renal congestion (albuminuria, red blood cells) was present, the improvement was less conspicuous and proceded at a slower rate. Dyspnea subsided promptly, but tachycardia persisted after the disappearance of edema. Effort caused prompt return of dyspnea and aggravated the tachycardia, indicating slow cardiac recovery. In one instance of dry beriberi dyspnea was striking and marked tachycardia present. It was felt that the vagus nerve shared in the polyneuritic reaction and was responsible for the respiratory and cardiac disturbance. Degenerative changes in the vagus nerve have been described and are thought to be responsible for some of the instances of sudden cardiac collapse.

Thirty five (35) cases of dry beriberi were admitted because of the severity of the disorder. These were cases in which the peripheral neuritis was so severe that extreme weakness, foot drop, and partial paralysis made locomotion difficult or impossible. The lower extremeties were most commonly affected, but weakness and inability to perform fine movements of the hands were also encountered. Usually bilateral, occasionally one extremity was particularly affected. In the short period of hospital care, subjective improvement was marked and slight to moderate improvement in coordination and muscular power was noted.

SECONDARY FINDINGS

Simple underweight (more than 20 pounds)	466
Anemia (Hemoglobin less than 14 gms)	440
Pyogenic Dermatitis	56
Visual disturbances	110
Ear disorders	51
Beriberi	78
Hookworm infestation	60
Ascariasis	50
G. Lamblia infestation	11
Hemmorhoids	7
Pellagra	9

Comment: Evidence of marked weight loss was striking. Where anemia was pronounced, iron by mouth, and in many instances transfusion of pooled type O whole blood was resorted to as corrective measures. Visual disturbances, either general diminution in visual acuity, conjunctivitis, or muscle imbalance were common, and were attributed chiefly to the general picture of avitaminosis. Impaired hearing was common, and in several instances striking. Many of the patients with diarrhea as their chief complaint exhibited the ova of hookworm, roundworm or giardia-lamblia in their stools. Many of the cases of debility, malnutrition and anemia may have been due to hookworm disease. Pellagra, manifested by glossitis and the characteristic skin lesions was encountered in only 9 instances, and appeared to be of secondary importance.

LABORATORY PROCEDURES
AND
FINDINGS

ANALYSIS AND COMMENT ON LABORATORY PROCEDURES:

I URINALYSIS

Albumen was present in 66 of the 976 urine specimens examined, an incidence of 6.7% (Table I). In 17 cases it was present to a marked degree. A microscopic examination of the centrifuged urine was done whenever albumen was present; granular casts were found in 11 instances.

TABLE IV

SERUM PROTEIN

Above 8.0	46
7 - 8	397
6 - 7	156
5 - 6	95
4 - 5	21
3 - 4	16

IV BACTERIOLOGY

Of the 314 sputums examined, 38 or 12% were positive for acid fast bacilli.

There were 27 cultures performed on feces - 8 showed pathogenic organisms. All organisms were in the Shigella group.

V FECES EXAMINATIONS (For ova and parasites)

Of the 320 stools examined, 185 or 58% showed one or more ova or parasites. Table V gives a tabulation of the findings.

TABLE V

OVA AND PARASITES IN FECES

Hookworm ova	60
A. lumbricoides ova	55
E. coli	42
E. histolytica	15
C. mesnili	11
E. nana	7
G. lamblia	11
T. trichiura	3
E. hominis	2
T. hominis	1
D. fragilis	1
Tapeworm ova (T. solium or T. saginata)	1
Adult A. Lumbricoides.	1

VI SEROLOGY

Two cases showed serum agglutination with proteus OX19 in dilutions of 1-5120. (Typhus fever). Other agglutination tests for E. Typhosa, S. shottmulleri, S. paratyphi and Proteus OXk (Scrub typhus) were negative.

VII PATHOLOGY

Three postmortem examinations were performed. The causes of death in the autopsied cases were respectively (1) Beriberi, heart disease; (2) Advanced miliary tuberculosis, (3) Advanced miliary tuberculosis.

X RAY FINDINGS

Total number of patients having chest X-ray	781
1. Tuberculosis with cavitation	25
2. Infiltration suggestive of tuberculosis without cavitation	26
(a) Minimal infiltration	15
(b) Moderate or advanced infiltration	9
(c) Miliary type of infiltration	2
3. Pleural effusion (estimated to be more than 400cc)	9
4. Minimal pleural effusion	27
5. Atypical pneumonia and suspected pneumonitis	25

5. In a miscellaneous group there were several healed rib fractures, two cases of empyema with resected ribs, one case of congenital heart disease, one case of acute pulmonary edema, and several cases showing slight developmental anomalies.

TABLE I

ALBUMINURIA (976 Examinations)

0 - 30 grams %	35
30 - 60 grams%	13
60 - 100 grams %	1
over 100 grams %	17

Red blood cells were present in the urine in 34 instances and white blood cells in 40, in 127 microscopic urine examinations.

Of 976 urines examined for sugar, 24 (2.4%) showed 1 plus reduction.

II HEMATOLOGY

The determination of hemoglobin and hematocrit, as well as serum protein, was done by the copper sulphate specific gravity method. Blood counts and other hematological procedures were also performed where specifically indicated.

Table II shows the distribution of the hematocrit readings, 52% were less than 40. (Normal 40 - 48).

TABLE II

HEMATOCRIT

60 and above	0
50 - 60	13
40 - 50	333
30 - 40	302
20 - 30	71
10 - 20	11

Of the hemoglobin examinations, 89% were less than 15.6 grams (Normal.) Table III shows the distribution of the hemoglobin readings determined by the specific gravity method.

TABLE III

HEMOGLOBIN

Above 15.6 grams	78
14 - 15.6	191
12 - 14	265
10 - 12	120
8 - 10	58
6 - 8	16
Less than 6 gms	1

Of 150 malaria smears, most of which were taken routinely, 8 (5.3%) were positive. All parasites found were P. vivax. A thick and a thin smear was examined in each instance. Positive smears were all from patients with fever.

III BLOOD CHEMISTRY

All blood sugar determinations were within normal limits.
The highest blood urea nitrogen found was 25 mgm. %.
Seven of the nine icterus index results were above normal; three were over 100; one was 210.
The serum protein determinations are tabulated in Table IV.

Summary and Discussion:

A statistical analysis of the medical processing and screening of 9,043 allied prisoners-of-war from camps in southwestern Japan (Kyushu) is presented. The presentation deals first with general information obtained from the entire group. This concerns itself with age, nationality, the presence or absence of fever, chills, dental trouble, edema, dysentery, skin trouble, malaria, lice infestation, respiratory infection, tuberculosis, and weight loss. The second part of the presentation concerns itself with an analysis of 717 of 888 patients admitted to the U.S.S. Haven (hospital ship) selected from the groups of 9,043 as requiring hospital care or further study before being allowed to be evacuated further by ordinary transport methods. In this latter group the analysis is divided into two parts (I) data obtained on questioning after admission to the hospital ship and (II), physical and technical findings after examination and study. The results are itemized and commented upon briefly under separate headings. A special section is devoted to a detailed description and comment in a large group of cases of beriberi (or edema).

The study has disclosed certain features which merit further comment or reiteration. It is possible to set quickly the physical and personnel facilities necessary to process medically large groups of prisoners-of-war, and to carry out such processing with a minimum of confusion and delay. It is of particular importance to bathe thoroughly and to de-louse the prisoners and their clothing by the generous use of DDT powder. Seriously-ill patients can be given a "stretcher bath" and de-loused before admission with very little delay or inconvenience. This procedure is recommended in order to prevent hospital infestation with body lice.

In the entire group which passed through the medical processing line there was an incidence of 50% dental trouble; 30.2% dysentery; 29.8 skin trouble (scabies, miliaria, pyogenic dermatitis, severe fungous infection, furunculosis, trophic changes, skin lesions of pellagra, and one case of lepromatous leprosy); 28.9% chronic cough; 3.2% hemophtysis; 50.2% fever and chills of more than a few days duration while prisoners; 64.0% lice infestation; 42.7% edema (usually dependent), and 95% weight loss, the highest being 110 pounds. Americans comprised 15.1% of the entire group and 25.6% of those admitted for hospital study. Dental decay, weight loss, edema, and other evidence of nutritional or deficiency disturbance was much less conspicuous among the Javanese Dutch then in the other groups. This is explained by the fact that the Javanese are better adapted to rice which was the chief component of the prison camp dietary. Many mild cases of amebic dysentery undoubtedly were not detected, and many of the diarrheas were on the basis of the deficiency disorders. Scabies was highly prevalent, as might be expected, and a sponging and spraying with 3% DDT in acetone and alcohol suffices to render the individual non-contagious. Pyogenic dermatitis, furunculosis, pigmentation and other trophic changes in the skin were extremely common. One case of lepromatous leprosy was encountered and mild pellagrous skin changes were not uncommon. Respiratory infections had been very common among the prisoners-of-war, and tuberculosis being especially prevalent. Apparently there had been a fairly high morbidity and mortality from pneumonia among the prisoners and this is readily understandable when one considers that these men were subject to the rigors of cold damp winters, improperly clothed, debilitated from other causes, after having come from tropical or subtropical climates. Tuberculosis as was expected, was more common than in a comparable age group of military personnel under normal military conditions of living. Malaria had been rife in the Philippine camps and in Burma and Thailand, but by the time that the men were liberated, it had ceased to be an important health disturbing factor by virtue of treatment and the natural course of the disease.

64% of all the prisoners-of-war complained of body lice infestation and this is a relative index of the unsanitary condition as well as opportunity for louse-born infection under which they existed. 42.7% complained of edema at some time during their confinement. This figure does not represent the true incidence of edema, however, because many were unaware of its presence when it could actually be demonstrated by the medical examiner. Usually dependent, it was occasionally generalized, of the type seen in nephrotic edema. How much of it was due to anemia and hypoproteinemia, and how much of it was due to the wet form of beriberi is difficult to state.

It is important to emphasize that the sudden acquisition and ingestion of large quantities of food (and salt) dropped among the camps by our B-29 airplanes after August 15th was associated with the rapid appearance of massive generalized edema in a large percentage of the prisoners-of-war. Among anemic, debilitated individuals already suffering from the nutritional and deficiency disturbances of water and salt balance, it is unwise to make large quantities of food and salt available without emphasizing at the same time the importance of careful eating, low salt intake, high vitamins, particularly B1, until proper water and salt balance has been restored. Weight loss was marked, and 75% of the entire group lost from 11 to 50 pounds. Many lost 80 to 100 pounds.

Analysis of the hospitalized group of 888 served to emphasize those features already commented upon. Beriberi (or edema) was the most common disorder among this group, being present in 326 of the 717 patients whose charts were sufficiently complete to warrant inclusion in this study. In 248 patients it was the primary cause for hospitalization, and 213 of these were of the wet form. Respiratory infections, chiefly tuberculosis (64 patients), chronic bronchitis (25 patients), and atypical pneumonia, were the next most common disorders in this group. Infectious jaundice was not infrequent and 2 patients with fever were determined to have typhus fever. Fractures of all types and infected amputation stumps were also common. Active malaria was encountered in only 10 patients and they were all of the relatively benign tertian type (p. vivax). Pyogenic dermatitis, furunculosis, carbuncles, were frequent. Ascariasis, and hookworm were common, the ova being found in 55 and 60 cases respectively of 320 stools examined. Twelve cases of severe burns were admitted, 9 of which were due to the atomic bomb.

Response of the wet form of beriberi (or edema) was prompt and, in most instances dramatic on high-proteins, high-carbohydrates, low salt, restricted fluids, bed rest, and high-vitamin intake, especially of B1, there was diuresis, weight loss of 5 - 25 pounds from loss of edema fluid, and corresponding subjective improvement.

15 cases of amebic dysentery were encountered. Of 300 stools examined 60 showed ova of hookworm and 55 ova of ascaris lumbricoides. Visual disturbances were frequent, as is common in patients suffering from the nutritional or deficiency disorders. The vision of only a relatively small percentage was brought to normal after correcting the refractive errors. This group showed slight edema of the retina, slight blurring of the disc margins, slight contraction of the form fields, and a few had central scotomas. A small percentage showed enough palor of the disc and alteration of the vessels and constricted form fields to warrant the diagnosis of early optic atrophy. Insufficient opportunity was afforded to measure the reaction to adequate and appropriate therapy.

A striking observation was the absence of psychoneurosis in this large group of men. This seems phenomenal when one realizes the normal incidence of psychoneurotic disorders and tendencies in any large military body. There were two frank psychotics requiring lock ward security but this incidence was far below the number one would expect from a group of similiar size living under far more favorable circumstances from the standpoint of mental hygeine.

One is of course impelled to speculate and to attempt to arrive at some sort of explanation for this remarkable state of affairs in the psychiatric field. It must be remembered that internment in the Japanese prison camps involved a return to extremely primitive living standards for most of the prisoners. The instinctual drive of self-preservation prevailed and the thoughts of all the prisoners were devoted chiefly to food and protection. As one prisoner put it "All you had on your mind was food-all conversation centered around food and getting through another day". The usual psychic mechanisms by which adjustment are made in our ample environment were useless and even dangerous.

From interviewing many of the prisoners, the opinion was gained that those who developed incapacitating psychic difficulties did so early in their confinement when the attitude of their captors was most brutal.

As a result the mentally as well as the physically incapacitated, fell victims of the brutality. It became a matter of survival of the fittest. Stated very bluntly it appears that those who developed psychoneurotic symptoms were either "killed or cured" by the Japanese methods. One might well conclude as a suggestion in psycho-therapy that when psychoneurotic manifestations avail a person nothing, least of all the evocation of sympathy, they are quickly dropped.

There were three deaths in the entire hospitalized group. One death was directly attributable to beriberi heart disease; the other two deaths were due to advanced tuberculosis. In this connection it is interesting to comment upon the mortality rate in the prison camps where careful records were kept. In camp Fukuoka #17 at Omuta, in a population of 1709 P.O.W.'s there were 118 deaths exclusive of 5 executions over a period of two years. This is an incidence of 32 per 1000 per year. In camp #11 there were 25 deaths in a period of slightly less than two years in a population of 402 giving an incidence of approximately 25 per thousand per year. These figures may be compared with an expected incidence of 3 to 4 per thousand in a military group not engaged in actual combat. The death rate of 6 to 10 times greater than normal in these camps is the best indication of the privations and hardships suffered by the prisoners of war.

Finally, it is worthy to comment upon the fact that the sending of supplies by international relief agencies to prisoner-of-war camps does not discharge their full responsibilities. Some method of enforcement to make these supplies actually available to the prisoners is necessary. Medical supplies for instance, had been sent to the camps in adequate amounts by the Red Cross, but they were not made available in adequate amounts because their distribution was usually controlled by Japanese privates or non-commissioned officers who had neither the inclination nor the knowledge necessary for their effective use and distribution. It is earnestly hoped that international agencies will devise some more effective methods for the future.

ENCLOSURE (B)

CLINICAL AND PATHOLOGICAL OBSERVATIONS

ON THE EFFECTS

OF THE

ATOMIC BOMB

The tremendous immediate destruction of life and property from the explosion of the single atomic bomb at Nagasaki is generally known. In the large area chiefly affected (Figure I), loss of property and of life was practically complete. In the surroundings, the destruction being widespread but of less magnitude, many persons were not killed outright by the explosion but sustained injuries. Many of the injured have died since; others have recovered or are recovering. Independent of mechanical or thermal injuries or the state of healing, there frequently developed signs and symptoms of an unusual syndrome which was in itself usually fatal. Observations were made on the pathology in those persons who developed the syndrome together with a study of skin burns due to the atomic bomb.

The U.S. Navy Hospital ship Haven, moored to a dock in Nagasaki harbor, began to receive prisoners of war 35 days after the bombing. It required a period of two weeks to complete the task. About a mile from the ship was a relatively intact schoolhouse which was being used by the Japanese as a hospital. There were about 300 civilian patients in the building. Much of the material for our report was obtained from that hospital; the remainder comes from observations made on prisoners of war who were admitted to the ship for the treatment of burns of the skin caused by the atomic bomb.

Procurement of material from the civilian hospital presented several difficulties. For one, it was obtained during an extremely busy two week interval when the ship's laboratory personnel was performing nearly 6,000 tests on patients aboard. In addition, there were language difficulties; specimens could not be brought promptly to the laboratory in all cases; there was a complete lack of facilities at the civilian hospital for refrigeration of bodies after death and prior to postmortem examination.

PART I - SKIN BURNS

INTRODUCTION

The following nine cases demonstrate the pathology of skin burns caused by the exploding atomic bomb. The nine victims were Javanese P.O.W. who were interned in "Camp #14", Nagasaki. This camp was just outside the area of extreme atomic bomb destruction; the burns were thus caused by the explosion of a bomb well over a mile away. (See sketch of area Fig. #1).

All were working in open areas at the moment of the atomic bomb explosion which occurred at 1100 hours, August 9, 1945. All were admitted to the U.S.N. Hospital Ship - HAVEN on September 13, 1945, thirty five days after exposure. They were transported to another station being aboard the "HAVEN" a period of two weeks. They were ambulatory, their wounds showed satisfactory healing and at the time of discharge, 49 days after exposure, all had gained weight and appeared cheerful.

CASE NO. ONE

NAME; LOUWAARS, H., AGE: 25, of Tjimahi, Java.

P.O.W.: Three one one half years; in Nagasaki, Kyushu two years four months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Jockey type - green fabric - paper and cotton.
Shirt:: Green - cotton, open collar and bosum, sleeves up.
Trousers: (Shorts) green, cotton fabric.
Shoes: Rubber - fabric - closed behind.

DUTY AT MOMENT OF LASH:

Carrying armload of boards.

DIRECTION OF FLASH:

Toward right side of body

DISTRIBUTION OF BURNS:

Face and Head: 2nd degree of right ear, temple and face with sharp protection line of cap at temple. Hair of right temple disappearing. 2nd degree of left face, anteriorly with protection area of nose. Hair on right side of upper lip sparse; disappearing.

Neck, shoulders and chest: V-shaped area corresponding to open collar and bosom of shirt.

Arms and forearms: 2nd and 3rd degree, Volar aspect of left forearm, wrist and fingers, dorsal and lateral aspect of right forearm. Streaks (2nd degree) anterior aspect of left shoulder. Lower extremities: 2nd degree streaks on anterior aspect of thighs, with 2nd and probable 3rd degree on anterior medial aspect of left leg; anterior-lateral aspect of right; streak burns of dorsum of each foot.

LABORATORY FINDINGS:

1. X-ray of chest - negative
2. Urinalysis - negative
3. Blood Proteins, 8.2 gms%
4. Hematocrit - 36.
5. Hemoglobin - 12.2 gms%

CLINICAL STATUS:

2nd and 3rd degree burns with bizarre distribution.

ILLUSTRATIONS:

Plates I, II, and III.

LEGEND FOR 16 MM COLOR FILM

About 450 feet - 9 prisoners of War showing skin burns from atomic bomb explosion - Augst 9, 1945 - Nagasaki, Kyushu. The cases are presented individually and in numerical order.

The first view of the patient illustrates his position, as well as he can remember, at the moment of the explosion. His face is turned in the direction of the flash. This is held about 3 seconds. When this position could not be recalled the film was begun with the patient in the anatomic position.

The second view shows him the anatomic position which he holds for a short period. Then he slowly raises his arms and hands, rotates the forearms, slowly turns his body through 360 degrees, followed by slowly raising and turning the face from side to side.

In a few instances, particularly in case 1, spot filming was done on some of the interesting areas. Illustrative areas are singled out by means of pointing and outlining with a pencil.

CASE NO. TWO

NAME: EVERLING, H. H. D. AGE: 25, of M[illegible]long, Middle J[illegible]v

P.O.W.: Three years, three months, in N[illegible]gasaki, Kyushu, two years five months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: None
Shirt: None
Trousers: Green, cotton, fabric, full length, (knee of right rouser leg torn).
Shoes: Rubber and cotton - high tops

DUTY AT MOMENT OF FLASH:

Not at work - empty handed.

DIRECTION OF FLASH:

To[illegible]rd left side of body from behind.

DISTRIBUTION OF BURNS:

2nd degree burns of left side offace, neck and back as far down as belt line. Protected areas are shown in depression over tips of vertebral spines and in shadow of vertebral border of left scapula. The remainder of the body is free of burns except at right knee where trouser was torn.

LABORATORY FINDINGS:

1. X-[illegible] of chest - [illegible]g tive
2. Blood [illegible]roteins - 7.9 gms%
3. H[illegible]globin - 12.8 gms.
4. Urinalysis - negative
5. Hematocrit - 38
6. WBC - 8,650 per cu mm.

CLINICAL STATUS:

2[illegible] degree burns with bizarre distribu[illegible]ion.

ILLUSTRATION:

Plates IV [illegible] V.

CASE NO. THREE

NAME: LAPRE, H. AGE: 27, of Tjikampek, Java.

P.O.W.E Three years, six months, in Nagasaki, Kyushu, two years five months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Green, cotton-paper fabric.
Shirt: None
Trousers: Green, cotton, full length.
Shoes: Rubber and cotton - high tops.

DUTY AT MOMENT OF FLASH:

Not at work - empty handed

DIRECTION OF FLASH:

Toward left side of body from front.

DISTRIBUTION OF BURNS:

2nd degree burns of left face, shoulders and chest wall to belt line. Protected area in front of chest due to arm, and another at left side of head due to ear shadow.

LABORATORY FINDINGS:

1. X-ray of chest - negative.
2. Blood Proteins - 8.8 gms%
3. Hemoglobin - 11.4 gms
4. Urinalysis - negative
5. Hematocrit - 34.
6. WBC - 11,400 per cu mm.

CLINICAL STATUS:

2nd degree burns with bizarre distribution.

ILLUSTRATIONS:

Plates VI and VII.

CASE NO. FOUR

NAME: BUSSELAAR, Gilles AGE: 29, of Javaweg, 44 bat. C, Java.

P.O.W.: Three years and six months, in Nagasaki, Kyushu two years six months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Cotton and paper, green.
Shirt: None
Trousers: Green cotton full length.
Shoes: Fabric and rubber, closed over heels with hooks.

DUTY AT MOMENT OF FLASH:

Carrying arm-load of scrap.

DIRECTION OF FLASH:

Toward left side of body.

DISTRIBUTION OF BURNS:

Left side of face, arm, shoulders, neck and back, chest burn on left side and front to belt line. Protected area caused by arm over chest.

LABORATORY FINDINGS:

1. X-ray of chest - negative
2. Blood Proteins - 7.3 gms%
3. Hemoglobin: 15.2 gms
4. Urinalysis - negative
5. Hematocrit - 45
6. BC - 5,200 per cu mm.

CLINICAL STATUS:

Second degree burns with bizarre distribution.

ILLUSTRATION:

Plates VIII and IX.

CASE NO. FIVE

NAME: LAPRE, Victor AGE: 23, of Tjikampek, West Java.

P.O.W.: Three years four months in Nagasaki, Kyushu, two years, five months.

CLOTHING AT MOMENT OF EXPOSURE:
Cap: Cotton, Green.
Shirt: None.
Trousers: Green cotton, full length.
Shoes: Leather shoes usual lacing.

DUTY AT MOMENT OF FLASH:
Carrying scrap.

DIRECTION OF FLASH:
Could not recall.

DISTRIBUTION OF BURNS:
Face, shoulders, arms anteriorly. Protected area at forehead caused by cap.

LABORATORY FINDINGS:
1. X-ray of chest - negative
2. Blood Proteins - 7.4 gms%
3. Hemoglobin - 14.2 gms
4. Urinalysis - negative
5. Hematocrit - 43.
6. WBC - 10,600 per cu mm.

CLINICAL STATUS:
2nd degree burns with bizarre distribution.

ILLUSTRATION:
Plate X.

CASE NO. SIX

NAME: CALLAEWERT, Albert B. AGE: 28, of Java.

P.O.W.: Three years, six months, in Nagasaki, Kyushu, two years five months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Green (yellow-brown) cotton.
Shirt: None.
Trousers: Green, rolled up above knees.
Shoes: Leather, high.

DUTY AT MOMENT OF FLASH:

Pushing cart.

DIRECTION OF FLASH:

Toward left side of body from behind.

DISTRIBUTION OF BURNS:

Lateral aspect of left arm, lateral and posterior aspect of left shoulder, all of back to belt line; left and posterior aspect of neck, lateral aspect of left leg, medial aspect of right leg. Protected areas due to vertebral border, of scapula and prominence of lumbar muscle groups.

LABORATORY FINDINGS:

1. X-ray of chest - negative
2. Blood Proteins - 8.2 gms%
3. Hemoglobin - 15 gms
4. Urinalysis - negative
5. Hematocrit - 45.
6. WBC - 9,200 per cu mm.

CLINICAL STATUS:

2nd degree burns with bizarre distribution.

ILLUSTRATION:

None.

CASE NO. SEVEN

NAME: van den Berg, Otto AGE: 22, of Poorwaredgo, Java.

P.O.W.: Three years, six months, in Nagasaki, Kyushu, two years, five months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Cotton, green.
Shirt: Grey brown, cotton, open at neck, sleeves up, (hole over left shoulder).
Trousers: Blue cotton, full length.
Shoes: Rubber fabric, high.

DUTY AT MOMENT OF FLASH:

Carrying scrap.

DIRECTION OF FLASH:

Toward face and front of body.

DISTRIBUTION OF BURNS:

Face, neck, ear, shoulders, and volar aspect of forearms, with evidence of healing and early contractures of neck and left ear. Protected areas, forehead, due to cap.

LABORATORY FINDINGS:

1. X-ray of chest - negative.
2. Blood Proteins - 6.3 gms%
3. Hemoglobin - 16.8 gms
4. Urinalysis - negative.
5. Hematocrit - 50
6. WBC - 9,050 per cu mm.

CLINICAL STATUS:

2nd and 3rd degree burns with bizarre distribution.

ILLUSTRATION:

Plates XI, XII, and XIII.

CASE NO. EIGHT

NAME: MULLER, John A. AGE: 32, of Java.

P.O.W.: Three years, six months, in Nagasaki, Kyushu, two years, six months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Green, gray, cotton.
Shirt: Brown cotton, open collar, sleeves up, (hole over left shoulder).
Trousers: Brown, cotton, full length.
Shoes: Rubber fabrick, high closed behind by hooks.

DUTY AT MOMENT OF FLASH:

Carrying scrap in open area.

DIRECTION OF FLASH:

Into face and body.

DISTRIBUTION OF BURNS:

Face, neck, volar, aspect of left forearm, top of right shoulder, streak burns of dorsums of fingers.

LABORATORY FINDINGS:

1. X-Ray of chest - negative
2. Blood Proteins - 7.9 gms%
3. Hemoglobin - 12.2 gms.
4. Urinalysis - negative
5. Hemotacrit - 36.
6. WBC - 6,850 per cu mm.

CLINICAL STATUS:

2nd degree burns with bizarre distribution.

ILLUSTRATION:

Plate XIV.

CASE NO. NINE

NAME: BUSSELAAR, Rene, AGE: 25, of Javaweg, 44 Bat.V., Java.

P.O.W.: Three years and six months, in Nagasaki, Kyushu, two tears, six months.

CLOTHING AT MOMENT OF EXPOSURE:

Cap: Cotton, green.
Shirt: Brown, green, collar and bosom open tail out, sleeves down.
Trousers: Brown green, cotton, full length, torn at knee.
Shoes: Leather shoes.

DUTY AT MOMENT OF FLASH:

Pushing cart in open area.

DIRECTION OF FLASH:

Obliquely toward face and body.

DISTRIBUTION OF BURNS:

Right face and ear. Right flank and back. Streak burns of dorsums of fingers right and left. Protection area: Nose shadow on left face.

LABORATORY FINDINGS:

1. X-ray of chest - negative
2. Blood proteins - 7.4 gms%
3. Hemoglobin - 14 gms
4. Urinalysis - negative.
5. Hematocrit - 42
6. WBC - 8,400 per cu mm.

CLINICAL STATUS:

2nd degree burns, healing, with bizarre distribution.

ILLUSTRATIONS:

Plates XV and XVI.

PART I - SKIN BURNS

DISCUSSION

The skin lesions of the nine cases had the appearance of ordinary second degree heat burns with an occasional area being deeper than the skin, without significant ulceration. A number of areas (Case 1) were encrusted with a dried serous exudate which could be lifted off in flakes. A few blebs (Case 1) were still present. Healing was in progress and a few superficial countractures were beginning to show, (Case 7 - Plates XI, XII, and XIII). Individually and from case to case there was much variation in the distribution and depth of the burns. Some of the lesions had sharp margins, others broad, some had both.

Distribution of Burns: The distribution was irregular. However in allowing "Protected Zones" for interposed objects such as hair, clothing, arms etc., (see plates I, II, VI, VII, VIII, and IX) the general distribution of the burns was in keeping with the attitude or position of the victim with respect to the direction of the flash at the moment of exposure. Hence only the side of the body facing the explosion showed burns, for example: when there were burns on the back there were none on the chest, they were present at times on one side of the face only, etc. (Review all plates for distribution, see protected zone of nose shadow on left side of face - Plate XVI).

Variation of depth due to Incidence of the Heat Rays: Like burns from exposure to the sun, those body surfaces directly facing the oncoming rays from the exploding bomb were more severly burned than those receiving rays obliquely. (See plate X and compare with others).

Protection by clothing: Each of the nine prisoners wore cotton clothing. The cap, Jockey type, was part paper and part cotton fabric. The shirts had collars and full length sleeves. Some of the prisoners were shirtless, and some had the sleeves rolled up above the elbows at the moment of exposure. The trousers were full length but one or two prisoners had reduced them to shorts. The shoes were a combination of cloth and rubber, without laces. They were fastened to the feet with hooks behind the heels. Two or three wore leather shoes. None wore socks.

The parts of the body covered by these articles of clothing were protected (Plate I, III, XIII, XIV). Those with open collars and shirt bosoms showed a typical V-shaped burn of the neck and chest (Plate I, III, XIII, and XIV). It was easy to spot the prisoner who wore shorts, for his legs from the knees down presented burns (Plate I). Those with their sleeves down received no burns of the forearms. Sharp burn margins paralleling the borders of the capbill and capband were found about the head. It was easy to foretell high or low shoes by the sharp margins above or below the ankles. The rays striking the body through holes in the clothing caused burns.

Clinical Status of the Prisoners: Other than the burns the clinical status of the men was considered good. There was no anemia, no leucopenia, no hemorrhagic dyscrasia, and the serum proteins were within normal levels. See Fig. #3.

Variation of depth due to Anatomical Contours of the Body: Over relatively even surfaces the burns were uniform. (See plates II, VII and IX). But those parts of the body characterized by rounded contours, such as the shoulder, and cylindrical forms of the fingers and arms, etc., (see plates II, V, X and XVI), presented variegated burns in keeping with the angle of exposure. There were streak burns along the fingers, recalling the shine from polished rods. In a similar way the burns of other contours of the body surface were irregular. Those surfaces, minute or appreciable, directly facing the flash were more deeply burned that their receding slopes.

The Margins of Burns: When struck obliquely by the rays those gradually sloping surfaces, due to anatomical contours, presented burns with broad margins. The width of the margins were proportional to the grade of the slope, (compare plates III and VII with V and X). Pigmentary changes were best observed at some of these margins. The scars of deeper burns showed little or no pigment. Bordering the scars were usually two zones of pigmentation; an inner light and an outer dark, representing grades of burning and tanning. (Review plates).

Protection by Hair: Long thick hair, such as that of the scalp, gave protection as was observed in one of the prisoners who was capless at the time of exposure (Plate IV). However short, sparse hair, such as that of the temple, closely dropped mustache, and unshaven beard, gave little or no protection. When such areas showed burns, the hair was beginning to disappear. (See plates II and XII).

Figure #2.

SUMMARY OF LABORATORY FINDINGS

CASE NO.	X-RAY OF CHEST	URIN-ALYSIS	SERUM PROTEINS	HEMATO-CRIT	HB	WBC
1	Neg.	Neg.	8.2	36	12.2	
2	Neg.	Neg.	7.9	38	12.8	8,650
3	Neg.	Neg.	8.8	34	11.4	11,400
4	Neg.	Neg.	7.3	45	15.2	5,200
5	Neg.	Neg.	7.4	43	14.2	10,600
6	Neg.	Neg.	8.2	45	15	9,200
7	Neg.	Neg.	6.3	50	16.8	9,050
8	Neg.	Neg.	7.9	36	12.2	6,850
9	Neg.	Neg.	7.4	42	14.5	8,400

Serum protein hemoglobin hematocrit findings were obtained by the copper sulfate specific gravity method.

CONCLUSIONS

1. Heat rays from the exploding atomic bomb produced 1st, 2nd, and 3rd degree burns of the skin in victims who were over a mile away from the explosion.

2. The distribution of the burns was comparable with that produced by exposure to the sun; it varied with the attitude or position of the victim with respect to the direction of the flash.

3. Like burns from exposure to the sun, those body surfaces directly facing the oncoming rays from the exploding bomb were more severely burned than those receiving the rays obliquely. (See plate X and compare with others).

4. Parts of the body covered by cotton fabric were completely protected.

5. Thick long hair gave complete protection; short sparse hair gave little or no protection.

6. There was no hematalogical evidence of injury to the blood forming tissue in these patients.

PART II

ATOMIC BOMB DISEASE

Among the survivors of the atomic bombing of Nagasaki there frequently developed a syndrome which was assumed to be caused by the radiation effects of the bomb. The Japanese were referring to the syndrome as "atombombendisease" Through the cooperation of the Japanese physicians, data on the clincial course of the disease was made available. It was also possible for us to obtain specimens of blood from living patients and to perform and observe necropsies on persons who had died from the malady.

CLINICAL COURSE

Composite data on the clinical course of atomic bomb disease obtained from Japanese physicians and from personal observations from visits to the civilian hospital showed that the onset of symptoms began from a few days to the third week after the bombing. Symptoms were similar in males and females and apparently were not influenced by age or related to the presence or absence of mechanical or thermal trauma. While weakness and general malaise were nearly constant prodromata, symptoms of anemia, anorexia, nausea, vomiting, and diarrhea usually marked the onset. The gums soon became swollen and painful; hemorrhages from the gum margins were frequent. Mild fever occurred early and was common. The throat became painful and small ulcers formed on the gums and about the tongue. There was a high incidence of melena, and hematemesis was occasionally noted. Many patients had "falling of the hair"; loss of teeth also occurred. As the patient's condition became worse, lassitude and weakness dominated the picture, the pulse became rapid and feeble,and hemic murmurs could be heard over the precordium. The patient sank into a state of extreme exhaustion with blood oozing from the gums and petechial hemorrhages becoming numerous. At times there appeared, during the height of the disease, signs and symptoms of "acute surgical abdomen" simulating acute pancreatitis, acute cholecystitis, etc.

There were no available figures as to the incidence of the disease among the survivors of the bombing. According to the Japanese, many had died with the illness in the first two weeks. At the time of our arrival an improvised civilian hospital contained about 300 sufferers with an approximate 16 to 18 admissions daily. In the two weeks that followed fewer admissions were made at the hospital and the number of recoveries began to rise. The mortality rate, nearly 100% during the first few weeks, had dropped to 50% or below in the 5th and 6th weeks.

In considering the clinical course of atomic bomb disease, one important fact must be kept in mind: facilities for the care of patients and for keeping clinical records were hopelessly inadequate. The partially destroyed schoolhouse used as an improvised hospital served for little more than a shelter. The sanitary and hygienic conditions were reduced to remarkably unhealthy levels. Rooms were open; doors and windows having been blown out. The patients, often 25 or 30 in a room, lay on the floor; during our period of observation (5th and 6th weeks) they received no objective treatment other than occasional use of Japanese penicillin and pentnucleotide.

The following clinical notes on a few of the cases admitted to the hospital are presented as they had been written in English for us by one of the Japanese internists who served a few times as our interpreter.

"H .N., age 31, female. - At the time of the explosion she was indoors; her home, 1500 meters from the center of the bombing, was destroyed. She received no radio-active burns and the traumas inflicted are now healed without scars. From September first she felt dull, weak and had slight fever, no hairs are falling out. A few days ago the gums became painful and swollen".

"Y.I., age 16, male - He was indoors. His home, 1500 meters away from the center of atom-bomb, was destroyed. He received traumas. No burns. The patient feels very ill, has remittent fever (37 - 38 C), drowsiness, nausea, vomiting and above all dysphagia and hemorrhage from the gums and stomach. He is anemic, his pulse is very feeble and rapid (120 min). There are petechiae on the chest and abdomen. The tongue is aphthous. Anemic murmurs can be heard over the base of the heart. The lungs are negative. The liver is 1 cm. and a little tender. There is one plus hematuria. RBC-878,000: WBC-1,350; bleeding time over 45 minutes; hemoglobin (Sahli) 15%; Color index 0.85".

"K.I., age 23, male - He was indoors so no radio-active burns. Of late he has noticed swelling of gums and has itching or some uncomfortable feeling when he takes food. He has slight fever and from time to time diarrhea. Objective signs very few other than petechiae here and there. Slight bleeding from gums. WBC-2,200".

"K.H., age 66, male - He was in open under a tree 1500 meters away from center of explosion. No radio-active burns. After a time he felt no abnormality but from September first he felt feeble and weak. Signs and symptoms: anemia, gums,(lower) gangrenous, teeth already fallen out, chest negative except hemic murmur over base. Slight fever. No hair falling out. Liver, 4 cms and little tender. RBC-262,000, WBC-4,100".

"Y.H., age 34, male - He was in laboratory 1000 meters away from the "centre". A week after the explosion his head became bald. He had remittent fever (37-38 C) with pain on swallowing food. Status: a little anemic, bald-headed (hairs coming out now). He is now recovering from the malady".

HEMATOLOGICAL STUDIES

Specimens of blood from 20 different patients were obtained from the Japanese civilian hospital. All patients were said to be suffering from atomic bomb disease. The samples were drawn by the Japanese staff and placed in oxalate bottles furnished by the ship's laboratory. Two of the specimens were from sternal marrow, the remainder blood. In the majority of instances an accompanying clinical note was furnished.

Due to the difficulty in transporting the samples promptly to the ship's laboratory for examination, satisfactory, complete, hematological studies could not be performed in each instance. The following procedures were done in most cases: red blood cell count, white blood cell count, differential count on stained blood smear (Wright and Giemsa stains), hematocrit determination, reticulocyte count, platelet count, color index determination, and estimation of plasma proteins.

Clinical Observations:

The sex of the patient was recorded in 16 cases; 10 were females, 6 were males. Data on the age was available in 14 instances: ages varied from 15 to 66 years, with the majority being between 20 and 40 years. There was no significant variation in the type or the severity of symptoms in relation to sex or age.

The distance of the patient from the center of the bomb explosion (recorded in 9 cases) varied from 0.2 Km. to 3.0 Km. Here again there was no notable difference in the symptoms or hematological findings relative to the distance, with the exception that as a rule those closer to the explosion had more severe symptoms.

The onset of symptoms began from a few days to the third week after the bombing. Most symptoms were persisting at the time that the blood specimen was taken (5th to 7th week); in some cases the symptoms had begun to abate, in others they had become increasingly severe. The commonest symptoms were loss of hair, fever, anorexia, malaise, dysphagia, diarrhea, and hemorrhages. The later were usually petechial, but in some cases there was bleeding from the gums, and one patient had hematuria. One 17 year old female had amenorrhea following the explosion.

Red Blood Cells:

The results of studies on the red blood cells in venous blood are listed in table I. All patients showed an anemia of considerable degree, the highest red cell count being 3,080,000 cells per cubic mm; the lowest count was 665,000. In spite of the anemia, which was often extreme, 8 of the 18 cases showed a reticulocyte count of over 1.0%. The hematocrit readings and the hemoglobin determinations were in keeping with the anemia. The majority of cases showed either a normochromic or hypochromic color index, however this determination is subject to error with such low cell counts and low hemoglobin figures. Stained smears occasionally showed nucleated red blood cells in the peripheral blood. There was relatively little achromia, anisocytosis or poikilocytosis, but there was often moderate basophilia.

TABLE I

Case No.	RBC	Ret	HB	HT	CI	Platelet	WBC
1	2.77	2.1	7.4	21.5	.80	147,075	5,100
2	2.20	0.6	4.2	12	.58	63,800	3,100
3	.665	0.7	3.4	10	1.5	29,260	1,900
4	3.11	1.6	8.7	26	.84	74,640	3,800
5	2.66	0.8	7.8	23	.88	103,740	1,900
6	3.17	1.8	9.6	28	.91	123,630	4,900
8	2.85	0.5	6.9	20	.73	94,050	2,100
9	3.00	1.9	8.6	25	.86	164,700	2,700
10	.995	0.5	2.0	5	.60	31,455	125
11	2.63	0.7	11.2	34	1.27	76,270	1,600
12	1.49	1.2	6.8	19	1.36	50,660	2,000
13	2.21	2.1	6.0	17	.81	101,660	2,250
14	2.48	0.9	8.5	23	1.03	120,080	3,400
16	2.71	0.5	10.0	29	1.10	165,310	2,650
17	1.62	0.7	8.9	26	1.64	93,960	4,900
18	3.08	1.1	10.8	32	1.05	127,040	1,750
19	2.82	0.9	10.5	31	1.11	177,660	3,900
20	3.02	2.8	10.3	30	1.02	129,860	3,950

White Blood Cells:

The results of the studies on the white blood cells in venous blood are seen in table I. Only one count was over 5,000. The lowest count was on specimen number 10 which showed after averaging repeated examinations, a total white cell count of 125 cells per cubic mm. About half of the blood smears showed a relative lymphocytosis, the remainder taken individually, were not considered to be unusual. Occasionally a smear showed 2 to 4% myelocytes but cells more immature than these were not found in the peripheral blood. There was in some smears an excess number of lymphocytes which showed lobed or "clover-leaf" nuclei. Often there were numerous degener-

ating neutrophiles. A few smears showed a preponderance of many lobed neutrophiles, but this was inconstant.

Platelets:

Platelet counts, while made from oxalate blood which was not always fresh, were nevertheless done on all cases. The counts were low in every instance, the lowest being 29,260 platelets per cubic mm. (table I). (Control counts on normal blood averaged over 300,000 the lowest being 258,030 per cubic mm.

Total Plasma Proteins:

An estimation of the total plasma protein was done in most cases. The results were low normal or slightly below normal, the average being about 6.0 grams %. The lowest plasma protein was 4.3 gms %.

TABLE II

STERNAL BONE MARROW

	Case #7	Case #15	95% range (Normal)
total nucleated cell count	2,100	29,700	6,000 to 70,000
Neutrophiles			
polymorphonuclears	7	20	7 to 25 %
stab	9	23	15 to 35
metamyelocytes	7	10	1 to 10
myelocytes	3	6	0.0 to 10
promyelocytes I	3	2.5	0.0 to 5
Promyelocytes II	0	2	0.0 to 2
Blast (stem)	1	5.5	0.0 to 2
Eosinophiles			
polymorphonuclears	1	1.5	0.0 to 1.0
stab	0	1.5	0.0 to 2.6
metamyelocytes) myelocytes)	0	1.5	0.0 to 2.0
Basophiles	0	0.5	0.0 to 0.2
Lymphocytes	59	3.0	4 to 16
Monocytes	1	0	0.0 to 5.0
Nucleated RBC	6	23	4 to 30
Reticulocytes	0.5	0.6	1 to 5

Bone Marrow:

Two of the blood specimens were drawn from the sternal bone marrow. The results of the examination are recorded in table II. No history is available in case #7, but case #15 represents a patient who had had severe symptoms but who clinically was recovering, there being no physical signs at the time the blood was drawn. Included in table II is the normal 95% range of the marrow cell count (Osgood[1]). Case #7 shows a marked depression of the granulocytic and erythropoietic series. There is a relative but not an absolute lymphocytosis. Case #15 shows the picture of an essentially normal marrow.

Comment:

The severe depression of the bone marrow is evident. As a typical example of the depression, case #10, which showed the most severe leukopenia in this series, is given below in more detail:

> Case #10. F.H., 17 year old Female. Patient was 1.0 Km. from the center of the explosion and received "wounds" on face, back, both arms, legs and feet. Anorexia continuous from 10th day. Beginning third week patient had nose bleeds, fever, petechiae, cough, otalgia, otorrhea, mucous diarrhea. Amenorrhea after injury. On September 14th blood examination at Japanese hospital (5 weeks after explosion): RBC 0.780, WBC 1,000.
>
> The specimen of blood examined at the ship laboratory was drawn on September 16th, two days after the above examination. The results of our examination are seen in Table I; there was a marked depression of red and white blood cells as well as platelets. A differential count was impossible because of the few white blood cells. Since extremely low results were obtained, the counts were done repeatedly; some mounts of blood, even with the blood drawn up to the 1 mark in the white cell pipette, failed to reveal any white blood cells. The average white blood cell count was 125 cells per cubic mm.

It must be remembered that the cases in this series were those who had survived for a period of 5 to 7 weeks after the initial injury and in some there was evidence of clinical recovery. The presence of a reticulocyte count of over 1.0% in numerous cases shows that some of the bone forming elements were attempting to function. Complete return to normal by the bone marrow can be assumed to be possible from the results of the examination of the marrow in case #15, the clinical note on which follows (as written in English by a Japanese physician):

Case #15 "S.K., 24 years, male workman. At the time of explosion he was outdoors, working, about 2 kilometers away from the center. Burns: on the face, arms, back, lower extremities. Radioactive burns already healed out. The main signs (disturbances) are: slight fever, headache, diarrhea (sometimes), pains in swallowing, petechiae: these all now healed. No physical signs just now. Leucocytic count: 7,000."

This case was said to represent the blood picture in recovery. As will be seen from table II, the marrow is essentially normal. However, this patient had had most of the typical symptoms which were present in others with the marked bone marrow depression. It seems safe to assume then, that there had been a marked suppression of the bone marrow at one time, but that this had entirely recovered.

Summary of Hematology:

1. A study of 18 venous and 2 bone marrow blood specimens taken from patients suffering from the late effects of atomic-bomb disease, shows evidence of severe bone marrow depression.
2. All elements of the bone marrow were depressed to about an average equal degree.
3. There is evidence that the suppression of the blood-forming elements is reversible.

POST MORTEM STUDIES

The following report is based upon the gross findings in seven necropsies. Microscopically vertebral marrow, spleen, and liver tissue were studied in every case while the femur marrow was studied in two. One of these is from the body of a child, the other a man of 66 yrs. In the total collection of tissues for study are specimens from nearly all the organs of the body.

The chief difficulties encountered were relative to care of the body between death and necropsy. There were no refrigeration facilities and sometimes there was several days delay in getting the permission of the family for the necropsy. Fortunately,a few the necropsies were performed only a few hours after death. Since the findings were rather constant from case to case the report of the gross pathology of case 2 will be given in full. Variations will be noted as they present themselves in the descriptions.

CASE #2

Name: Y.S., age 21, male. Expired 9/15/45 at 8:45 am.
examined 9/15/45 10 am.
CLINICAL EXCERPT: "Lived 800 meters from center of bomb explosion site. When his home was demolished he received trauma to the back. Injuries had healed readily. On 9/12/45 he became very ill having fever, pethechiae, stomach ache, bloody stools and tenesmus".

The Lungs:

Both lungs are pinkish gray, soft, fluffy and uniformly crepitant. There are several thread-and-string like tags of fibrous tissue over the apex of each lung where the pleura was slightly thickened. Elsewhere the pleura is thin, smooth transparent and shining. But beneath it are groups of petechiae particularly on the lateral and diaphragmatic surfaces. Small areas of edema and hyperemia are found along the borders but the posterior dependent positions appear purplish and the pleura over them is moist. These areas on section are moist and small amounts of clear frothy fluid exude on pressure. The only remarkable changes about the trachea and bronchi are scattered petichiae in the pale thin mucosa. The tracheobronchial and hilar lymph nodes are small soft, and pink. There is a minimum of coal dust pigmentation.

VARIATIONS: This case presented a minimum of hypostatic congestion as compared to others. In only one case was there sufficient change to suggest terminal bronchopneumia grossly. (Case 5).

The Liver:

The liver is of normal size and shape. Its surface is bluish gray, smooth and glistening. The surfaces made by sectioning are purplish brown. The gall bladder contains dark brown bile.

VARIATIONS: This case was an exception to the general rule. Often the liver appeared slightly swollen as evidenced by slight eversion of the cut edges of the capsule. In case 7. the liver was jaundiced. In case 5. there was much more congestion, and the gall bladder was purplish black soft necrotic mass. It contained no stones.

Pancreas:

Not remarkable.

VARIATIONS: In case 7. the pancreas was a firm swollen mass nottled purplish black due to areas of hemorrhage. Though there were hemorrhages throughout the whole organ the head appeared to be better preserved.

Spleen:

The organ is moderately small, moderately soft, and contracted. Its capsule is slate blue and wrinkled. The surfaces made by sectioning are purplish gray and dry. Delicate gray streaks corresponding to vessels and tracheculae are clearly visible but Malpighian bodies are not identified.

(In four cases the average weight was 61 grams. The minimum was 40, the maximum 76 grams).

POST MORTEM EXAMINATION:

The body is that of a pale well developed Japanese male, 167 cms. long, estimated to weigh about 150 lbs. There are no scars or evidence of trauma about the body. Numerous petechiae and small ecchymoses are in the skin of the face, neck, shoulder, thorax and abdomen, and extremities. Close inspection reveals a single petechial hemorrhage in the left eye and several in the mucosa of the lips. The gums are receded, edematous and soft with dirty gray zones about the dentogingival margins. The teeth are not loosened, the hair of the scalp is not remarkable. There are no other noteworthy external findings.

VARIATIONS: The only variations to these findings were jaundice, in case 7; and a shallow moist gray ulcer of the skin over the external malleolus of the right leg about 2 cms across, in case 1.

The Peritoneal Cavity:

There is no free fluid. Beneath the serosa, particularly about the root of the mesentery, are numerous ecchymoses. The level of the diaphragm is normal. The lower border of the liver does not show below the right costal margin. The intestinal tract is relatively empty. Localized areas of edema and florid hyperemia are found in the mesocolon of the sigmoid and rectum.

VARIATIONS: Small amount of seros anguiseous fluid in the cavity in case 7. The liver border was not found to be more than 1 or 2 cms. below the right costal margin. No cases of peritonitis were encountered.

The Thoracic Cavity:

There is no free fluid. The lungs collapse normally as the chest is opened fibrous adhesions are found over the apex to each lung.

The Pericardial Cavity:

Not remarkable.

The Heart:

Is normal in size, weight and position. Beneath the epicardium, particularly along the coronary sulcus, are clusters of petechiae. The myocardium is purplish brown, uniform in texture and appearance, and, except for a rare small area of hemorrhage, is considered normal. There are no remarkable changes observed about the endocardium, papillary muscles, and their chordae tendineae, leaflets and cusps of the various valves, or the atria and their appendages.

The Aorta:

Not remarkable. (There were very few atheromatous changes among the vessels of the seven cases. The coronary arteries were not remarkable).

Adrenals:

Each is normal in size, shape and position. Their cortices are pale yellow and about 1 to 2 mms thick. A thin zone of brown pigment showed in each. Their medullae were gray and translucent.

VARIATIONS: Occasionally an ecchymosis was found in the soft peri-adrenal tissues.

Kidneys:

Their capsuls strip readily. There are no remarkable changes other than moderate parenchymal capillovenous congestion and groups of petechiae in mucosa of the calyces and pelves.

Urinary Bladder:

Except for petechiae in the mucosa, the bladder is negative.

The Prostate:

Not remarkable in size or shape. It is of normal consistency.

The Testes:

Not remarkable in size or shape. The surfaces made by sectioning are grayish yellow. The seminiferous tubules can be pulled out in long threads.

VARIATIONS: Some of our cases were females. In none of them was there significant pathological change in the internal gentalia.

Lymphnodes:

Everywhere are purplish red soft, moist and conspicuous by their color. They are not enlarged.

Gastro-Intestinal Tract:

In the esophagus no change what ever is found. In the stomach small eccymoses and petechiae in clusters are numerous in the mucosa. The mucosa of the duodenum is a deep purple red. Here and there isolated segments of the small intestine are moderately congested. As a whole the mucosa of the first half of the colon is pale. At the level of hyperemia and edema of the mesocolon, the mucosa is purplish red, slightly thickened, and covered with a thin film of liquid blood. These areas are in the rectum and sigmoid colons. In the routine examination of the intestinal contents severeral adult A. lumbricoides are found.

VARIATIONS: In all cases some degree of hemorrhage, greater than petechiae and ecchymoses, was observed in the terminal portion of the colon. In case 4 the mucosa was a thickened black sloughing membrane for a distance of 18 inches. Such areas, though smaller appear to be a rather constant finding among all the autopsied cases according to the Japanese. A. lumbricoides were found in all cases

The Bone Marrow:

That of the ribs and vertebral bodies is red, semi-liquid and when expressed from the cancellous bone has a rather translucent appearance.

VARIATIONS: Though all cases showed similar marrow findings in the ribs and vertebrae, it appeared quite different in the femur. In case 4, an adult, and case 7, a child, the marrow of the extremities of this bone was yellowish and gelatinous, while that in the mid region was yellowish red.

The Brain was examined in all cases but no abnormalities of note were discovered other than congestion of the meningeal vessels and scattered petechiae. No changes were discovered in the thymus and thyroid glands. In two cases (cases 1 and 5) the tongue and pharnyx were dissected out. Along the borders of the tongue were one or two small shallow punched-out ulcers corresponding in size and position to the surfaces of the lower teeth. Their craters were gray and moist. The tonsils were not enlarged but appeared as black moist soft bodies between the pillars. They had the gross appearance of necrosis. The pharyngeal walls were not thickened or covered with exudate but petechiae and ecchymoses were visible.

MICROSCOPIC EXAMINATION

Bone Marrow:

The marrow in 4 of the cases shows marked reduction of all the blood forming cells. In two other cases (3 and 4) there is moderate reduction of all the elements. However in case #7 the marrow is normally cellular showing foci of erythropoiesis. An impression smear of the latter marrow, made at the time of the necropsy and stained with Giemsa, reveals the cells of the leucocyte series to be predominantly blasts and myelocytes, with relatively few mature and maturing leucocytes; megakaryocytes are reduced in number.

Spleen:

There is a definite reduction in the amount of lymphatic tissue. The Malpighian bodies contain conspicuous pale areas in which the cells are large, pink staining and contain debris. There is no condensation of lymphocytes at the margins of there bodies. Generally the nuclei of the red pulp belong to fixed structure with a marked reduction in the number of free cells. Only in case 4 the cells of the red pulp appeared in normal variety and number. In no instance however were there recognizable foci suggesting erythropoiesis. There is no pigmentation.

Lymphnodes:

The lymphocytes of the follicles and cords are not crowded and no pale areas are observed. The sinuses are lined with prominent endothelial cells and detached rounded forms are free in the sinus spaces. With them generally are numerous erythrocytes and occasionally erythrophagocytosis is observed. There is no pigmentation.

Liver:

Generally the cytoplasm of the liver cells is uniformly granular. In a few cases small fat vacuoles were found in the cells of those portions of the hepatic cords nearest the efferent veins. Generally the sinusoids are small, contain relatively few blood cells, and much granular precipitate. Foci of hematopoiesis, abnormal pigmentation, and proliferation of endothelium are absent.

Intestinal Tract:

Sections of the lower end of the colon revealed necrosis of the mucosa and submucosa with marked hemorrhage and edema. The meagre leukocytic infiltration is chiefly perivascular and consists almost entirely of mononucleated cells. The muscularis is well preserved. A section of the duodenum shows similar changes.

Testis:

A slide from a case, age 21, showed active spermatogenesis. In two cases ages 15 and 16 yrs, the seminiferous tubules appear underdeveloped and show no mature or maturing spermatozoa. But an occasional mitosis is found in the thin germinal epithelium. The interstitial tissues appear normal.

Adrenal:

There is pronounced lipoid depletion of the cells of the cortex. Extravasation of blood is seen in the outer part of the capsule.

Other Tissues:

There are representative slides of the heart, kidney, lungs, thymus, etc., all of which show minimum parenchymatous changes. There are no vascular or collagen changes similar to those seen after therapeutic irradiation of tissues.

Summary of Pathological Findings:

For the most part the gross and microscopic findings are those relative to a well defined retrogressive process in the bone marrow and its associative changes throughout the body. It is characterized by moderate to marked reduction of all the blood forming elements of the marrow. Minute changes in the parenchymatous organs are relatively insignificant.

Comment:

Our primary function at Nagasaki was the evacuation and hospitalization of prisoners of war. Material and data concerning the effects of the atomic bomb were gathered as time and conditions permitted. A comprehensive survey of the state of health of the Hapanese was neither possible nor justifiable. The results of our study are therefore reported objectively; only one or two points need special comment.

The signs, symptoms, clinical course, hematological and necropsy findings in the patients with atomic bomb disease are entirely comparable to those found in patients receiving a large generalized dose of gamma radiation. The depressing effect of such radiation on the bone marrow with the resulting anemia, leukopenia and thrombocytopenia is well known, as are the systemic symptoms of "radiation sickness": nausea, vomiting, prostration, bloody diarrhea, fever, and headache.

In spite of the fact that the patients were hospitalized in the open, subjected to the hazards of infection and denied specific and general therapeutic measures, the bone marrow in some cases showed evidence of recovery. It thus seems apparent that if adequate medical care had been given victims of atomic bomb disease the mortality rate would have been much lower.

CONCLUSIONS

1. Among the survivors of the atomic bombing of Nagasaki there developed a disease, often fatal, which was apparently independent of mechanical or thermal injuries.

2. A clinical and pathological sutdy of the disease showed it to be entirely comparable in all respects to the syndrome caused by a large generalized dose of gamma radiation.

3. The mortality of the disease would have been much lower provided that adequate medical care had been given.