TECHNICAL REPORT
17-59
業績報告書

ORIGINAL SIGNS AND SYMPTOMS IN PATIENTS SURVIVING FIVE YEARS AFTER ATOMIC BOMB EXPOSURE UNDER 1000 METERS

1000m以内で原爆に被爆し5年以上生存した者に被爆当時現われた徴候及び症状

JACK J. LEWIS, M.D.
HELEN A. PATTERSON, B.A.

ATOMIC BOMB CASUALTY COMMISSION
ABCC

THE ABCC TECHNICAL REPORT SERIES
ＡＢＣＣ　業績報告集

The ABCC Technical Reports provide a focal reference for the work of the Atomic Bomb Casualty Commission. They provide the authorized bilingual statements required to meet the needs of both Japanese and American components of the staff, consultants, advisory councils, and affiliated governmental and private organizations. The reports are designed to facilitate discussion of work in progress preparatory to publication, to record the results of studies of limited interest unsuitable for publication, to furnish data of general reference value, and to register the finished work of the Commission. As they are not for bibliographic reference, copies of Technical Reports are numbered and distribution is limited to the staff of the Commission and to allied scientific groups.

この業績報告書は、ＡＢＣＣの今後の活動に対して重点的の参考資料を提供しようとするものであって、ＡＢＣＣ職員・顧問・協議会・政府及び民間の関係諸団体等の要求に応ずるための記録である。これは、実施中で未発表の研究の検討に役立たせ、学問的に興味が限定せられていて発表に適しない研究の成果を収録し、或は広く参考になるような資料を提供し、又　ＡＢＣＣに於て完成せられた業績を記録するために計画されたものである。論文は文献としての引用を目的とするものではないから、この業績報告書各冊には一連番号を付してＡＢＣＣ職員及び関係方面にのみ配布する。

TECHNICAL REPORT
17-59
業 績 報 告 書

ORIGINAL SIGNS AND SYMPTOMS IN PATIENTS SURVIVING FIVE YEARS AFTER ATOMIC BOMB EXPOSURE UNDER 1000 METERS

1000m以内で原爆に被爆し5年以上生存した者に被爆当時現われた徴候及び症状

JACK J. LEWIS, M.D.[1]
HELEN A. PATTERSON, B.A.[2]

From the Departments of Medicine[1] and Statistics[2].
臨床部[1]　　統計部[2]

ATOMIC BOMB CASUALTY COMMISSION
Hiroshima - Nagasaki, Japan

A Research Agency of the
U.S. NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL
under a grant from
U.S. ATOMIC ENERGY COMMISSION
administered in cooperation with the
JAPANESE NATIONAL INSTITUTE OF HEALTH of the MINISTRY OF HEALTH & WELFARE

原 爆 傷 害 調 査 委 員 会
広島－長崎

厚生省国立予防衛生研究所
と共同運営される
米国学士院－学術会議の在日調査研究機関
（米国原子力委員会研究費に依る）

ACKNOWLEDGMENT

感謝の言葉

We wish to thank Dr. L. Woodbury and Miss I. Murray
of the Division of Biostatistics, Atomic Bomb Casualty Commission,
for their great aid and encouragement.

原爆傷害調査委員会統計部の Dr. L. Woodbury 及び Miss I. Murray
より，絶大なる援助及び奨励を頂いたことに対し謝意を表し度いと思う．

This report was published in the following journal:

この報告書は下記の雑誌に掲載された．

"American Journal of Surgery, Volume 98, July, 1959"

Table of Contents
目 次

List of Tables
挿入表一覧表

INTRODUCTION

Numerous reports have been published reviewing the signs and symptoms of atomic bomb victims.[1-5] These reports, although dealing many times with the same patients, approached the medical aspects from different viewpoints. Subsequently, other investigators re-evaluated again the dreadful events and consequences of that clear August morning in 1945.[6-8] The reasons for the intense interest in the early complaints of the victims are obvious: a new disease syndrome; the specter of malignancies, blood dyscrasias and genetic mutations; flash burns due to unrivaled intensities of radiant heat; and the evaluation of a new weapon of warfare and a new source of energy for peaceful purposes.

This report deals only with survivors who were exposed 1000 meters or less from the hypocenter in Hiroshima and were living at least five years after the dropping of the atomic bomb. Although a thermonuclear weapon was detonated in March, 1954, at Bikini Isle, it does not render obsolete the findings in the population of Hiroshima following the atomic bomb explosion. With a thermonuclear weapon, the scale of injuries will be many times greater, but the types of injuries will be similar.

History

The Hiroshima bomb was detonated at an altitude of approximately 580 meters at 8:15 a.m. on August 6, 1945. Immediately many Japanese scientists began making mental notes of what happened to them and to the hordes of patients arriving at the temporary clinics and first-aid stations.[9] About 48 hours later the first Japanese investigating teams arrived in the chaotic city. These teams were from the huge scientific centers, such as Tokyo, Kyoto,

緒言

原子爆弾の被爆者が呈した徴候及び症状を検討した多数の報告書が発表されている.[1-5] これ等の報告書は屡々同じ被爆者を取り扱つているが, 医学的に異つた観点から検討している. その後他の研究者は, 1945年8月の晴天の朝起つた災害を再吟味した.[6-8] 新疾患の症候群, 悪性腫瘍, 血液疾患及び遺伝的突然異変, 類例のない強烈な輻射熱による熱傷, 及び新兵器と平和目的の新エネルギー源としての評価等の問題がある故, 被爆者の初期の訴えについて強い関心が寄せられる理由は明白である.

この報告書は, 爆心地より1000m 以内の広島で被爆し, その後少なくとも5ケ年以上生存した者を対象にした. 1954年3月にビキニ島で熱核兵器が爆発したが, それが原子爆弾を受けた広島の被爆者に関する所見を, 時代遅れのものにはしない. 熱核兵器では, 死傷率は幾倍も増加するだろうが, 傷害の種類は同様であろう.

歴史

広島の原子爆弾は1945年8月6日午前8時15分高度約 580 mで爆発した. その後間もなく臨時診療所及び救護所に殺到した被災者と日本科学者の活躍については科学者の体験として発表された.[9] 被爆後約48時間後, 東京, 京都, 大阪, 岡山, 九州等にある学術機関から派遣された日本人調査班の第一陣がこの混沌たる都市に到着した. このす

Osaka, Okayama and Kyushu. Their brilliant work[2] was handed to the American team which entered Hiroshima about a month later. The American group, which was commonly known as the Joint Commission, was composed of Navy, Army and Japanese personnel, and those from the Manhattan project. The Joint Commission completed their task by the beginning of 1946. Using the Japanese findings as a foundation, they expanded, confirmed and carried out further studies.[1] During the month of November, 1945, the Joint Commission was joined by a British Survey Team which evaluated the damage in the light of their experiences during the London "blitz".[5,10] From January to November, 1946, there were no American investigating groups in Hiroshima as far as could be ascertained. In November 1946, a small group known as the Brues-Henshaw Commission entered Hiroshima. This group had military as well as civilian personnel and took the name Atomic Bomb Casualty Commission (ABCC).[11] In April, 1947, by act of Congress, the Committee on Atomic Casualties was formed. This group took over the name Atomic Bomb Casualty Commission and it is this commission which is still carrying on investigations in Hiroshima.

ばらしい仕事[2]は約1ケ月後に広島に到着した米国班に引き継がれた．一般に合同調査団と呼称されたこの米国班は，米陸海軍，日本人学者，及びManhattan計画に属した人々より構成されていた．合同調査団は，1946年の初めまでにその仕事を済ませ，日本人側の所見を基礎として調査範囲を拡大し，その結果を確認し，更に調査を遂行した．1945年11月に英国調査班が合同調査団と合流し，ロンドンの“大空爆”[5,10]中の体験に基づいて原爆の災害を検討した．1946年1月より11月まで広島には米人調査団は居なかつたものと思われる．1946年11月に Brues-Henshaw 調査団として呼ばれた軍人及び民間人より成る小さい班が広島に到着したが，その後この班は原爆傷害調査委員会（ＡＢＣＣ）と呼称された．[11] 1947年4月，米国議会が定めた法令により原子傷害委員会が設置された．この委員会が原爆傷害調査委員会と云う名称を引き継ぎ，広島で今尚調査を実施している．

Materials and Methods

In 1949, ABCC conducted a census of all survivors of the atomic bomb in Hiroshima. This took six months to complete. One thousand fifty persons were found who had been exposed within 1000 meters from the hypocenter. This group served as the basis for the Adult Medical Program (ME-55) which was started in 1951. This program was composed of (1) all survivors exposed under 1000 meters and 10 per cent of the survivors exposed within 1500 meters, totaling approximately 2500 people, and (2) a control group consisting mainly of (a) people matched by sex and age with the exposed group, residing in the city of Kure (about 20 miles from Hiroshima) and (b) persons who moved into Hiroshima after January 1, 1946.

資料及び方法

1949年ＡＢＣＣは広島の全被爆生存者の調査を実施したが，この仕事は6ケ月を要した．この調査によつて爆心地より1000m以内で被爆したものを1500名発見した．この集団が1951年に開始された成人医学研究計画（ＭＥ－55）の基礎となつた．この計画の対象者は下記の通りである．即ち，（1）1000 m 以内の全被爆生存者と1500 m 以内の被爆生存者の10％，合計約2500名及び（2）（a）呉市（広島市南方，約32km）居住者で性別，年令において被爆群と組合わせた者と（b）1946年1月1日以後広島に転入した者より成る対照群．

The Adult Medical Program started in 1951. All survivors on that program (and the few children on the pediatric program) exposed within 1000 meters from the hypocenter were included in this study if they were still alive. There were 619 patients; 431 persons of the total 1050 were lost due to death, refusal or inability to locate. Each case making up this paper was reviewed independently by each of us, and if there was any disagreement in a finding, we both reviewed the case.

1951年に開始された成人医学研究計画に属する爆心地より1000m以内で被爆した生存者全員（及び小児研究計画に属する少数の児童）を本調査の対象にした．対象総数1050名中，死亡，受診拒否，住居不明等のため431名の損失を見たので619名について検討した．本書の各例について著者は単独に検討し，もし2人の所見の間に相違が生じた場合は，2人でその症例を再検討した．

Each patient was evaluated in two ways: (1) from the radiation symptoms and signs and (2) from the traumatic history. The radiation symptoms and signs were assigned numerical values as follows: vomiting, 1; fever, 2; oropharyngeal lesions, 4; purpura or petechia, 8; epilation of any degree, 16. Patients with any number or combination of numbers totaling between 8 through 31 were labeled severely radiated; from 4 to 7, moderately radiated; and from 1 through 3 lightly radiated. The basis for choosing the radiation symptoms enumerated were the chi square contingency tables between radiation symptoms worked out by Dr. L. Woodbury.[12]

各例は2つの方法で検討された．即ち，（1）放射線症状及び徴候及び（2）外傷歴に基づいて行なつた．放射線症状及び徴候に対し次の様に数値が割当てられた．即ち嘔吐1，発熱2，口腔咽頭部病変4，紫斑病又は点状出血8，あらゆる程度の脱毛16，その数値又はその合計が8～31となつたものは強度の被爆例として，4～7のものは中等度の被爆例とし，1～3のものは軽度の被爆例として取扱つた．放射線症状に対する数値の選択の基準は L. Woodbury [12] が作成した分割表によつた．

The evaluation of trauma was much more difficult. The effects of blast, burn and mechanical injuries were weighed by a doctor and patients were placed in one of the following 3 categories: (1) lightly injured, (2) moderately injured and (3) severely injured. These groupings were on a subjective basis. However, a patient so crippled by injury that he would have to depend on others for survival was classified in group 3. This group did not include persons temporarily unconscious who were able to care for themselves on recovery. Patients severely injured but capable of locomotion without aid were placed in group 2, e.g., punctured eyeball or fractured fibula. All patients with lesser type injuries were classed in group 1.

外傷の検討は一層困難であつた．爆風の影響，火傷及び機械的傷害が医師により考察され，対象者を次の3つに分類した．即ち，（1）軽度の負傷，（2）中等度の負傷，（3）重篤な負傷．これ等の分類は主観に基づいて行なつた．しかしながら，強度の負傷のため身体が不自由になり他人の救助によつて生存できたものは第3群に入れた．この群には，一時的に意識不明となつたが意識が回復して自分で避難したものは含まれなかつた．重傷であつたが，援助なしに運動することの出来るものは，例えば，穿孔眼球又は腓骨の骨折は第2群に入れた．これより軽度の負傷者は全部第1群に分類した．

RESULTS

Trauma. There were 619 patients in the sample studied; 55 per cent were females and 45 per cent were males. (Table 1) Most of the females were in their twenties, while the males were mainly in their forties. One might surmise that the numerous work parties in the city of Hiroshima would be composed of these age groups, as the females in their twenties are the most resilient and the strongest; the males in the third and fourth decades were in the Imperial Armed Forces. There were no children in the first decade in this sample. This has been explained by any one or a combination of the following factors[13]: "(1) A large mortality rate among children as a result of the bombing. (2) The evacuation of children from the cities prior to the bombing. (3) The inability to get exact information from young children."

結果

外傷 外傷を検討した対象者は619名で55%は女性，45%は男性であつた．（表1） 女性の大部分は20代で男性は主に40代であつた．20代の女性の回復力と体力が共に最も強く，30—40代の男性は従軍していたから，広島市の数多くの勤労奉仕隊は，前記の年令層に属しているものによつて構成されていたことが推測される．この対象群において，10代の児童はいなかつた．これは下記の因子の何れか又はその組合わせによるものと見做される.[13] 即ち，“（1） 被爆による児童の高い死亡率（2）爆弾投下前都市よりの児童の疎開（3）児童から正確な資料入手の困難なること”

TABLE 1. SEX AND AGE OF PATIENTS IN SAMPLE*

表1 対象者の性及び年齢*

AGE AT TIME OF BOMB IN YEARS 原爆時の年齢（才）	MALE 男性	FEMALE 女性	TOTAL 計
10 - 19	49 (17)	92 (27)	141 (23)
20 - 29	46 (16)	111 (33)	157 (25)
30 - 39	60 (21)	60 (18)	120 (19)
40 - 49	70 (25)	50 (15)	120 (19)
50 - 59	44 (16)	16 (5)	60 (10)
60 - OVER 以上	12 (4)	9 (3)	21 (3)
TOTAL 計	281 (45)	338 (55)	619 (100)

**All tables herein list both the absolute numbers of persons in various categories and the percentages in parentheses.*

* 本報告の各表には各種分類に属する者の絶対値及び括弧内に百分率を示した．

The sample by exposure distance confirms the fact that there were more survivors the further the distance from the hypocenter. There were no differences due to sex. (Table 2)

対象者を被爆距離別に検討した時爆心地よりの距離が遠くなればなる程，それだけ生存者の数は多くなると云うことが判る．男女には相違がない.（表 2）

In the number of injuries per person, excluding radiation injury, there was one person without any injury and 97 people with abrasions. People with only one

放射線傷害を除いた1人当りの傷害数は，無傷の者1名，擦過傷97名であつた．唯1つの傷を受けたものは，対象者の60%であつて20%は2つ

TABLE 2. SAMPLE BY EXPOSURE DISTANCE

表2　被爆距離別の対象者

EXPOSURE DISTANCE IN METERS 爆心地よりの距離（m）	MALE 男性	FEMALE 女性	TOTAL 計
001 - 250	2 (0.7)	-	2 (0.3)
251 - 500	14 (5.0)	17 (5.0)	31 (5.0)
501 - 750	47 (16.7)	57 (16.9)	104 (16.8)
751 - 1000	218 (77.6)	264 (78.1)	482 (77.9)
TOTAL 計	281 (45)	338 (55)	619 (100)

injury represented 60 per cent of the sample, 20 per cent had two injuries and 2 per cent had three injuries. Lacerations accounted for 80 per cent of all injuries, burns for 25 per cent and contusions for 15 per cent. It might be supposed that contusions should be the most common injury as undoubtedly most of the lacerations had a contused area.

の傷を有し，2％は3つの傷を有した負傷者のうち80％は裂傷を受け，25％は火傷及び15％は打撲傷を受けた．裂傷の殆んどには，疑いもなく打撲部があつたと思われるので打撲傷は最も普通の傷害であると考えられる．

In the group with two injuries, there were 57 people with the combination of burns and lacerations, 45 with contusions and lacerations, and 12 with burns and contusions. Of the 12 persons with the combination of three injuries, five had the combination of burns, contusions and lacerations.

2つの傷を有する群では，火傷及び裂傷の合併傷を有する者57名，打撲傷及び裂傷を有する者45名，火傷及び打撲傷を有する者12名であつた．3つの傷の合併傷を有する12名中，火傷，打撲傷及び裂傷の合併傷を有する者5名であつた．

The body was divided into five areas in locating injuries: (1) head, face, neck; (2) upper extremity; (3) thorax, back; (4) abdomen, pelvic girdle, genitalia; and (5) lower extremity.

人体部位の傷害個所を指定するために，5つに分割した．即ち（1）頭，顔，頸（2）上肢，（3）胸廓，背（4）腹部，骨盤帯，生殖器及び（5）下肢．

Of the number of body areas injured, 221 persons had two areas injured and 226 persons had only one body area injured. Twenty-five people had injuries to all the body areas, ten to three body areas and 34 to four of the body areas.

負傷部位別では221名が2部位を負傷し226名が唯1部位のみを負傷していた．25名は，全身に負傷，10名は3部位に，34名は4部位に負傷していた．

During World War II, in the inter-war period, and during the Korean conflict, pleas were voiced[14-16] for the accurate

第二次世界戦争中，その後の平和期間中及び朝鮮事変中，傷の正確な部位を知りたいと要請さ

location of wounds. Unfortunately the same chaotic conditions existing during combat were present following the bombing.

The head, face, neck area and the upper extremity area were the locations of the majority of the injuries. There appears to be a difference between the sexes as to number of injuries to the lower extremity ($P = 0.001$). The females with the higher percentage may have, in the privacy of their dwellings, shed their "*mompei*"* since it was early in the morning and during the heat of the summer. This would have removed a protective covering from flying glass and tile, and the flash.

The maximum duration of healing in mechanical injury ranged from less than one week to almost two years. (Table 3) In evaluating this type of injury for triage, the stockpiling of the equipment and the availability of beds, as to occurrence and duration the 25, 50, 75, 90, and 95 per cent levels were selected. Fifty per cent of the patients were completely healed by the fourth week following injury. By the twentieth week 90 per cent were healed, and four weeks later 95 per cent were healed.

れた.[14-16] 遺憾ながら原爆後には，戦闘中に存在したと同様な大混乱があつた.

負傷部位は大部分頭部，顔面，頸部及び上肢であつた．しかし，下肢に対する負傷数については男女間に差異（P＝0.001）がある様である．女性がより高値の負傷率（%）を有するのは，原爆の時間は朝早く且つ夏の暑い期間中であつたので，女性は自宅に居た関係で“もんぺ”* を脱いでいたのかも知れない．従つて飛散する硝子，瓦及び閃光に対する防御が取り除かれていたことになる.

機械的傷害の最大治癒期間は，1週間以下より殆んど2ケ年間にも及んだ．（表3） この種の傷害の発生率及び治療期間について，負傷者の分類と医療品及び病床の準備を検討するに当り，25%，50%，75%，90%及び95%水準のものを選んだ．負傷者の50%は，受傷後第4週間以内に全治した．20週間以内には，90%が治癒し，それより4週間後には95%が治癒した.

TABLE 3. DURATION OF HEALING

表3 治癒に要した期間

TYPE OF INJURY 傷害の型	TOTAL ACCUMULATIVE PER CENT 累積%				
	25	50	75	90	95
MECHANICAL 機械的	2 weeks 週	4 weeks 週	11 weeks 週	20 weeks 週	24 weeks 週
LACERATION 裂傷	1 week, 週 2 days 日	3 weeks, 週 6 days 日	10 weeks 週	20 weeks 週	23 weeks 週
FLASH BURN 熱傷	3 weeks 週	3 weeks, 週 5 days 日	9 weeks 週	16 weeks 週	23 weeks 週

Burns. There were 12 fire burns and 128 flash burns. The fire burns were contact burns; the flash burns were due to radiant heat transmitted in the visible and infrared regions of the spectrum.[17] The

火傷 対象者のうち火傷12例，熱傷 128例があつた．火傷は 接触火傷であり，熱傷はスペクトル[17]の可視及び赤外線の部分によつて伝達される輻射

*Female work trousers demanded of all Japanese women during World War II.

*女性作業ズボンで，第二次世界戦争中日本女性はその着用を強要された.

ultraviolet rays caused erythema but no burn. When an atomic bomb explodes, the flash is divided into two periods.[4] At first there is a short blue-white flash lasting about 0.01 second; this radiation does not persist long enough to ignite the surfaces on which it falls. This flash is followed by a longer flash which dies away relatively slowly.[2] Starting at about 20 to 25 milliseconds, skin burns are produced, with the most severe occurring between 0.1 and 0.2 second. By increasing increments of exposure, the major severity of thermal burns was attained within the first 0.3 second after the bomb exploded and the maximum severity within the first 0.5 second. No burns were produced after the first 0.6 second.[17] Therefore, protection from the flash between 0.1 and 0.6 second after occurrence would result in no burn. Species differences and skin pigmentation also play a role in the severity of burns. Dark pigmentation at the same distance caused a more severe and more penetrating burn than light pigmentation; healing also took longer.[17] It is plausible to assume that the injuries due to flash burns may have been more severe because of skin pigmentation in our sample of Japanese people.

In 126 cases of flash burns (Table 3), 50 per cent were healed by the fourth week, 90 per cent by the eighteenth week and 95 per cent by the twenty-third week.

The majority of the cases of flash burns healed by primary intention. About 10 per cent (13 cases) had keloids; in only one of the 13 cases suppuration did not occur. Suppuration was present in 66 of the cases (52 per cent). (Table 4)

Only 12 persons gave a history of fire burns. (Table 4) No keloids developed but there were several instances of suppuration.

Lacerations were the most common mechanical injury; 222 persons of 495 so injured gave a history of known duration of healing. (Table 3) Glass cuts represented 72 per cent of all lacerations.

熱に因つて生じた．紫外線は，紅疹を生じたが火傷は生じなかつた．原子爆弾が爆発する際，その閃光は２つの段階に分けられる．[4] 先ず第一段階で，約0.01秒間継続する短かい蒼白の閃光があつて，この放射は被射体面を発火させる程持続しない．この閃光の次に更に長い閃光が起り，これは比較的に緩慢に消滅する．[2] 約20～25ミリ秒で始まり，皮膚に火傷が生じ最も重篤な火傷が生じるのは，0.1 及び0.2 秒間である．爆発と被爆時間との関係を見た時，熱傷を起す効果は主として爆発後最初の0.3 秒以内に見られ，最初の0.5 秒以内が，その効果が最も強烈であつた．最初の0.6 秒[17] 以降は火傷を生じなかつた．従つて爆発後0.1 ～0.6 秒間に閃光に対して遮蔽があれば，火傷は生じない．人種の相違及び皮膚の色素沈着も火傷の程度を左右する．即ち同距離において被爆した場合でも色素沈着の多いものには色素沈着の少ないものよりも重篤且つ深い火傷が生じ，治癒ももつと長くかかつた．[17] 熱傷は対象である日本人の皮膚の色素沈着の関係上，重篤であつたと思われるのは容易に想像される．

熱傷の126症例（表３）において，50％は第４週目までに，90％は第18週目までに，95％は第23週目までに夫々治癒した．

大多数の熱傷症例は，第一期癒合によつて治癒した．約10％（13例）はケロイドを有し，13例中唯１例にのみ，化膿がなかつた．化膿が認められたのは，症例中66例（52％）であつた．（表４）

僅かに12名が火傷を受けたと述べた．（表４）この12名にはケロイドは生じなかつたが，数例に化膿があつた．

裂傷は最も普通の機械的傷害であつたが，裂傷を受けた495 名中 222名は，治癒に要した日時について述べた．（表３） 硝子による切傷は全裂傷の72％を占めた．50％は第４週目に，90％は

The 50 per cent level of healing was at 4 weeks, the 90 per cent level at 20 weeks, and the 95 per cent level at 24 weeks. The type of healing was recalled by 486 patients with lacerations. (Table 4) Almost 50 per cent had suppuration of their wounds, although the majority healed by primary intention.

第20週目に，95%は第24週目に夫々治癒した．裂傷を有する 486名は治癒の様相について記憶していた．(表４) 大多数は第一期癒合によつて治癒したが，約50%のものは化膿した．

TABLE 4. TYPE OF HEALING

表4　治癒の型

TYPE OF HEALING 治癒の型	FLASH BURNS 熱傷	FIRE BURNS 火傷	LACERATIONS 裂傷
PRIMARY INTENTION 第一期癒合	59 (46.8)	7	261 (53.7)
KELOID, WITH PRIMARY HEALING ケロイド，第一期治癒	1 (0.8)	0	0
KELOID, SUPPURATION WITH DELAYED HEALING ケロイド，化膿と治癒の遅延	5 (4.0)	0	0
KELOID, SUPPURATION WITHOUT DELAYED HEALING ケロイド，化膿したが治癒の遅延なし	7 (5.6)	0	0
NO KELOID, SUPPURATION WITH DELAYED HEALING 無ケロイド，化膿と治癒の遅延	17 (13.5)	2	152 (31.3)
NO KELOID, SUPPURATION WITHOUT DELAYED HEALING 無ケロイド，化膿したが治癒の遅延なし	35 (27.8)	3	73 (15.0)
NO KELOID, SUPPURATION, NON-HEALING 無ケロイド，化膿と不治	2 (1.6)	0	0
TOTAL 計	126	12	486

There were few skeletal injuries (total 27), and it is surmised that most patients with multiple fractures or a single incapacitating fracture perished in the "fire storms". Other fractures were undoubtedly missed because the patient never even suspected a fracture and it was only by x-ray examination that the diagnosis was made. Most of the fractures healed well with good alignment (15 of 23). Only two patients had delayed healing. Six patients had poor alignment although the fracture healed well. The type of healing was unknown in four.

骨格損傷の例は少なかつた（合計27）．従つて，多発骨折乃至は身体の自由を奪う単純骨折を有する大部分の被爆者は，“火災”のため死亡したものと思われる．その他の骨折は，骨折があるのではないかと疑うことさえしなかつたし，診断が下されたのは，X線検査によつてのみであつた故，見逃がされたものと思われる．大抵の骨折の治癒は順調で整復は良好であつたが（23例中15），２名に治癒が遅延した．骨折の治癒が順調で整復の不良なもの６名を認めた．４名において治療経過が不明であつた．

Forty-eight patients were found to have a complication resulting from healing. (Table 5) It is well known that many

48名の治癒の結果合併傷害が生じた．(表５) どんな型の外傷を受けた被害者でもその後の事実，

victims of any type of trauma always place the blame for any illness real or imaginary on that event. Certainly the victims of the atomic bomb were not exceptions. However, the psychoneuroses and neuroses that may have resulted from that explosion were ignored in this study. The one patient listed as having a psychobiological complication was a schizophrenic. Whether she gave evidence of this condition prior to the bomb cannot be resolved. Twenty-eight patients suffered cosmetic disfigurement and it certainly can be assumed that there was some psychological overlay. The 34 cases of physical incapacitation were mainly due to contractures following burns.

又は，空想的な疾患を当時受けた外傷に起因するものだと訴えるのが常である． 確かにこの事は，原爆被災者の場合例外ではなかつた．しかしながら，被爆の結果生じたと思われる精神神経症及び神経症は，本研究では取扱わなかつた．精神生物学的な合併症をもつ者として記録された1例は精神分裂症であつたが，被爆前にこの異常があつたかどうかは明瞭でない．28名は美容的醜形があつたので，ある程度の心理学的な負担があるものと考えられる．34名には身体障害があつたが，これは主として火傷後の攣縮に起因した．

TABLE 5. COMPLICATIONS OF HEALING
表5 治癒の合併症

COMPLICATIONS 合併症	MALE 男性	FEMALE 女性	TOTAL 計
PSYCHOBIOLOGICAL 精神生物学的	0	1	1
COSMETIC DISFIGUREMENT 美容的醜形	5	8	13
PHYSICAL INCAPACITATION 身体障害	10	9	19
COSMETIC DISFIGUREMENT PLUS PHYSICAL INCAPACITATION 美容的醜形＋身体障害	7	8	15
TOTAL 計	22 (45.8)	26 (54.2)	48

Summarizing the severity of the trauma (Table 6), less than 1 per cent were very severely injured and about 93 per cent had mild traumatic injuries. Certainly this was to be expected, as the severely injured did not survive.

外傷の程度を要約すると（表6）1％以下は非常な重傷，約93％は軽度の外傷を受く．重傷者は死亡したのでこれは全く予期された通りであつた．

Blast. Blast injuries as such have not been mentioned. There were very few reports of such in Hiroshima and this quotation from the British Mission's report[5] is a very appropriate one:

爆風 所謂爆風による傷害は対象者にはなかつた．この様な例を広島で認められたと云う報告は極く少数しかない．従つて下記の英国調査団の報告[5]からの引用は，最も適切なものと考える．

"In Nagasaki but not in Hiroshima, a

“多数の人々が爆風により裂開され，内臓は

rumor was current which age has made almost respectable, for it appeared in the London Blitz and before that in Barcelona during the Spanish Civil War. This was that large numbers of people had been ripped open by the blast, and their entrails exposed; their eyes and tongues were said to have hung out. Experience in this country (England) has shown that blast pressure alone does not in fact cause these sensational effects on the human body. It was, therefore, not unexpected that two Nagasaki survivors who had spoken of seeing hundreds or thousands of such bodies on examination reduced their claim to one or two. Flying debris would be expected to produce a few such injuries. Cases of genuine injury from high blast pressures, such as ruptured eardrums, were rare among survivors."

露出，眼及び舌が外に垂れ下がつたと云う風評が広島では起らなかつたが，長崎では流布した．ロンドンの大空爆及びそれ以前では，スペインの内乱中のバルセロナ市において同様な傷害があつたので，その風評は年月と共に相当信用される様になつた．英国における経験では，爆風の圧力のみでは実際に人体にこれ等の物凄い傷害を起さないと云うことが示された．従つて，幾百幾千の斯る傷害を受けた被災者を見たと云う２名の長崎被爆生存者を入念に調べて見た所，その主張する数を１名乃至２名に限定した．これは予想外のことではなかつた．飛散する破片が斯る傷害を少数もたらすものと思われる．鼓膜の穿孔等，実際爆風の圧力による傷害を受けた症例は，被爆生存者の中にはまれであつた."

TABLE 6. DEGREE OF TRAUMA

表６　外傷の程度

SEVERITY OF TRAUMA 外傷の程度	MALE 男　性	FEMALE 女　性	TOTAL 計
NONE TO MILD 無より軽度	260 (92.6)	314 (93.0)	574 (92.7)
MODERATELY SEVERE 中等度	20 (7.1)	23 (6.8)	43 (6.9)
VERY SEVERE 極めて重篤	1 (0.4)	1 (0.3)	2 (0.3)
TOTAL　計	281	338	619

Radiation Signs and Symptoms. As mentioned earlier, radiation injury was based on vomiting, fever, oropharyngeal lesions, purpura and epilation. There were 490 patients with symptoms, representing almost 80 per cent. (Table 7) The vast majority had severe radiation injuries with purpura and/or epilation, and perhaps other symptoms.

Fever and/or vomiting were the least significant symptoms of radiation injury,

放射線の徴候及び症状　前述の様に，放射線傷害は，嘔吐，発熱，口腔咽頭の病変，紫斑及び脱毛に基づいて分類した．490名に症状を認めたが，これは殆んど80％に当る．（表７）　大多数の人々には，紫斑乃至脱毛及び恐らく他の症状を伴う重篤な放射線傷害があつた．

生物学的且つ統計学的に，[12] 発熱乃至嘔吐は，放射線傷害の最も有意でない症状であつて，対象

both biologically and statistically,[12] and were evidenced by 74 per cent of the sample. (Table 8) The 50 per cent level of these symptoms occurred within hours of the detonation; these patients almost without exception had the symptom of vomiting. At the end of one week almost 75 per cent of this group had symptoms. The 90 and 95 per cent levels were reached in the fourth week. The duration at the 50 per cent level was two weeks and the main symptom was fever. (Table 9)

者の74%にこれを認めた.（表８） これ等症状を呈した者の50%には被爆後数時間以内に症状が現われ，これ等患者等は，殆んど例外なく嘔吐の症状があつた．１週の末に，この群の殆んど75%に症状が現われた．第４週目には，90と95%に達した．50%の群における持続期間は，２週間で，主な症状は発熱であつた.（表９）

TABLE 7. SEVERITY OF RADIATION SYMPTOMS
表７ 放射線症状の程度

SEVERITY 程 度	MALE 男 性	FEMALE 女 性	TOTAL 計
NO SYMPTOMS 無症状	69 (24.6)	60 (17.8)	129 (20.8)
MILD SYMPTOMS 軽度の症状	30 (10.7)	33 (9.8)	63 (10.2)
MODERATE SYMPTOMS 中等度の症状	0	0	0
SEVERE SYMPTOMS 重篤な症状	182 (64.8)	245 (72.5)	427 (69.0)
TOTAL 計	281 (45.4)	338 (54.6)	619 (100)
TOTAL NUMBER WITH SYMPTOMS AND PER CENT OF 619 PATIENTS 症状を有する総数及び619名の%	212 (75.4)	278 (82.2)	490 (79.2)
PER CENT OF 490 PATIENTS 490名の%	212 (43.3)	278 (56.7)	490 (100)

Oropharyngeal lesions (Table 8) were most difficult to evaluate from the history. The final criterion was ulceration of the oropharyngeal mucosa. Undoubtedly many cases did not meet this standard. When this type of lesion was present, the 50 per cent level was reached in the third week with the 90 and 95 per cent levels attained in the fifth week. The duration of this injury (Table 9) was comparatively short, 50 per cent being healed in two weeks and 95 per cent within eight weeks.

口腔咽頭病変（表８）は，病歴より評価するのに最も困難であつた．最終的判定基準は，口腔咽頭粘膜の潰瘍であつたが，多くの症例は，疑いもなく，この基準に達しなかつた．この種の病変を呈した者の50%には第３週目にこの病変が現われ，90と95%には第５週目に現われた．この傷害の持続期間（表９）は，比較的に短かく，50%の群は２週間で，95%の群は８週間で治癒した.

Purpura, which included petechiae and spontaneous bleeding from the gums,

点状出血及び歯齦の自然出血を含む紫斑は，重篤な放射線傷害と見做した．この病状は素人に

signified severe radiation injury. It was a manifestation startingly noticed by the layman, easily remembered and not influenced by the age of the patient. Over 50 per cent of the sample (Table 8) had this symptom, with the 50 per cent level occurring in the third week, the 90 per cent level in the fifth week and the 95 per cent level in the sixth week. This sign lasted for two weeks (Table 9) for the 50 per cent level, and by nine weeks had disappeared for the 95 per cent level.

も驚く程はつきりと認められるもので，容易に記憶され且つ被爆者の年令によつて影響されなかつた．対象者の50%以上（表8）は，この症状を有し，50%の群は第3週目に，90%の群は第5週目に，そして95%の群は第6週目に 症状を呈した．この徴候は50%の群では，2週 間持続し（表9）95%の群では，9週目までに消失した．

TABLE 8. ONSET OF RADIATION SIGNS AND SYMPTOMS

表8 放射線徴候及び症状の発現

SYMPTOM 症 状	TOTAL ACCUMULATIVE PER CENT 累 積 %				
	25	50	75	90	95
FEVER AND/OR VOMITING 発熱乃至嘔吐	? hour 時間	? hour 時間	1 week 週	4 weeks 週	4 weeks 週
OROPHARYNGEAL LESIONS 口腔咽頭の病変	1½ weeks 週	3 weeks 週	3½ weeks 週	5 weeks 週	5 weeks 週
PURPURA 紫 斑	1½ weeks 週	3 weeks 週	3½ weeks 週	5 weeks 週	6 weeks 週
EPILATION 脱 毛	>1 week 週	2 weeks 週	4 weeks 週	6 weeks 週	8 weeks 週

TABLE 9. DURATION OF RADIATION SYMPTOMS

表9 放射線症状の持続期間

SYMPTOM 症 状	TOTAL ACCUMULATIVE PER CENT 累 積 %				
	25	50	75	90	95
FEVER AND/OR VOMITING 発熱乃至嘔吐	6 days 日	2 weeks 週	2 weeks 週	2 weeks 週	2 weeks 週
OROPHARYNGEAL LESIONS 口腔咽頭の病変	1 week 週	2 weeks 週	3½ weeks 週	6 weeks 週	8 weeks 週
PURPURA 紫 斑	<1 week 週	2 weeks 週	3½ weeks 週	7 weeks 週	8 weeks 週

Epilation (Table 8) was also a sign of severe radiation injury. It was startling and well remembered, but suffers as an indication of radiation because there appears to be a relationship with age,[12] and also many men are bald-headed. The disappearance of epilation or reappearance of hair is not a good end point. The 50 per cent level occurred in the second week and the 95 per cent level in the eighth week. Although duration could not be evaluated, the degree of epilation was noted. (Table 8) Over 60 per cent of the epilated patients lost almost their complete head of hair. Many patients remarked that their new growth of hair was at first finer and of a red tinge.

In trying to relate the traumatic injury to the radiation injury, it was believed that an inverse relationship might appear; the more severely traumatized the less severely radiated and, conversely, the less severely traumatized the more severely radiated. This was not borne out by analysis.

From these results one can hypothesize the modal patient in this sample study who survived at least five years after an atomic explosion and who was exposed within 1000 meters. This patient was a 20 to 29 year old female exposed between 750 and 1000 meters from the atomic bomb. There was a 60 per cent chance of being lacerated and a 20 per cent chance of being burned. If an injury occurred it was most likely to the head-face-neck area or to an upper extremity. For any type of trauma the likelihood was that the injury healed by primary intention within four weeks. There was very little chance of any permanent complication of healing.

There was an 80 per cent chance of some radiation sign or symptom appearing. If there was fever and/or vomiting it probably started the first day (vomiting) and lasted two weeks (fever). If there were oro-pharyngeal lesions they appeared within three weeks and had a two-week duration. Purpura would be apparent within three weeks and would last three weeks. Epil-

脱毛（表８）も重篤な放射線傷害の徴候であつた．これ又，驚く程はつきり認められるものでよく記憶されていた徴候であつたが，年令との関係[12]があると思われその上多くの男性には禿げ頭があつたので，放射線照射のよい標識ではない．又脱毛の消退乃至は頭髪の再発生は，良好な結果標識ではない．50％のものは第２週目に，95％のものは第８週目に脱毛した．症状の持続期間は，評価され得なかつたが，脱毛の程度は確認出来た．（表８） 脱毛した者の60％以上は，殆んど完全に頭髪を失つた．多くの脱毛例は，新しく生え代つた髪が，初めは薄く，赤味を帯びていたという．

外傷性傷害と放射線傷害との関連を検討した所，両者の間には逆の関係が存在するかも知れないと考えられた．即ち，外傷が重篤であればそれだけ被爆線量が少なく，又逆に外傷が軽ければ，それだけ被爆線量を多く受けたものと思われた．これは解析では証明されなかつた．

これ等の結果より，爆心地より1000ｍ以内で被爆し，原爆後少なくとも５ケ年間生存した対象者のモードを仮定することが出来る．このモードは，原爆地点より750～1000mの所で被爆した20～29才の女性であつた．裂傷を受ける可能性が60％，火傷を負う可能性が20％あつた．もし傷害が起るとすれば，それは恐らく頭部，顔面，頸部又は上肢に生じた．各種外傷は４週間以内に第一期癒合によつて治癒した．治癒において永久的な合併症が生じるという可能性は極めて少なかつた．

放射線徴候乃至は症状が出現する可能性は80％であつた．もし発熱又は嘔吐があるようなら，恐らく第１日目に嘔吐が始まり，発熱が２週間続いたであろう．もし口腔咽頭の病変があつたなら，３週間以内に出現し，２週間持続した．紫斑は３週間以内に出現し，３週間持続するだろう．脱毛は２週間以内に始まり，頭皮の76～100％にわたつたであろう．

ation would begin within two weeks and would involve 76 to 100 per cent of the scalp.

This modal patient would experience severe radiation and mild trauma.

Several other studies similar to the present one have been made. It is of interest to compare the results. Table 10 lists the percentages of radiation, mechanical and thermal injuries found at different times by various investigators. These results were compared in the groups exposed through 1000 meters. An excellent survey by Snell[7] could not be used, as his closest surviving group was exposed up to 1.0 mile(1600m). The Hatano survey[6] had a sample of 100 people, 91 of whom were exposed within 1000 meters. Figuring that 10 per cent were exposed beyond 1000 meters, this percentage was used to exclude the injuries that survey listed for the entire sample. As can be seen in Table 10, the

このモード被爆者は，多量な放射線と軽度の外傷を受けたであろう．

本研究に類似した他の研究が行なわれたが，それらの結果を比較することは興味あることと思われる．表10は種々の研究者により異なる時に調べた放射線傷害，機械的傷害，熱傷の百分率である．これらの結果は，爆心より1000ｍ以内の距離で被爆した者の比較である．Snell[7]の調査は優秀であるが，彼の対象者は1600ｍ以遠であつたのでこの比較から除外した．羽田野の調査[6]では対象は100名でその中91名は，1000m以内で被爆した．10％が1000ｍ以遠で被爆したものと考えられるので全対象の傷害例数から10％を差引いた．表10に示す様に合同調査団の数値及び本報告は非常によ

TABLE 10. COMPARISON OF PERCENTAGES OF INJURIES FOUND AT DIFFERENT TIMES BY VARIOUS INVESTIGATORS

表10　調査団別の異る時期において判明した傷害の百分率の比較

TYPE OF INJURY 損傷の型	J.I.*2 AUG. 6, 1945 1945年8月6日	J.I.2-J.C.**1 AUG. 8, 1945 1945年8月8日	J.C.1 SEPT. 1945 1945年9月	HATANO[6] NOV. 1945 1945年11月	ABCC*** JAN. 1955 1955年1月
	TIME ELAPSED 経過した時間				
		% DEAD BEFORE 20 DAYS 20日以内の死亡者 %	% ALIVE AFTER 20 DAYS 20日以後の生存者 %	% ALIVE AFTER 104 DAYS 104日以後の生存者％	% ALIVE AFTER 5 YEARS 5年以後の生存者 %
RADIATION 放射線	100	95.1	81.2	24.7	79.2
SEVERE RADIATION SYMPTOMS 強度の放射線症状	-	58.5	75.2	-	69.0
BURNS 火傷	90	57.2	25.1	16.0	24.4
MECHANICAL 機械的	-	57.2	61.8	71.8	88.7

*Japanese Investigation Group *日本側調査団　**Joint Commission ** 合同調査団　***Present Report ***現在の報告

figures of the Joint Commission and this report are very similar. However, over-all there appears to be an increase in mechanical injuries and a decrease in thermal and radiation injuries. The increase in mechanical injuries could conceivably be due to the patients remembering injuries either occurred or imagined and not remembered five years previously, although this is very doubtful. The decrease in complaints due to thermal and radiation injury could be due to lapse of memory.

く類似している．しかしながら，全体から見た場合機械的傷害は増加し，熱傷及び放射線傷害は，減少している様に思われる．機械的傷害の増加は本調査の時対象者が発生したか又は想像した傷害を記憶したが，５年前にはこれ等傷害を記憶していなかつたためかも知れないが，これには極めて大きな疑問がある．熱傷及び放射線傷害の減少は，時間の経過による記憶の喪失によるものであろう．

TABLE 11. NUMBER OF DEATHS BY TYPE OF INJURY AND EXPOSURE DISTANCE
表11　傷害の型及び被爆距離別の死亡数

INJURY　傷　害	DISTANCE FROM HYPOCENTER IN METERS 爆心地よりの距離（m）				TOTAL 計
	0-250	250-500	500-750	750-1000	
BURNS 火　傷	0	0	1 (33.3)	2 (66.7)	3
RADIATION INJURY 放射線傷害	1 (3.2)	2 (6.4)	2 (6.4)	26 (74.0)	31
RADIATION INJURY AND BURNS 放射線傷害及び火傷	0	0	1 (14.3)	6 (75.7)	7
NEITHER なし	0	1 (7.7)	3 (23.1)	9 (69.2)	13
TOTAL　計	1	3	7	43	54

There is another possibility which must be investigated: have the groups which were exposed within 1000 meters with radiation and/or thermal injuries been dying at a faster rate than the groups with mechanical injuries or no injuries? In an effort to see if such a hypothesis could be advanced, all deaths of the exposed population within 1000 meters on the ME-55 program were collected. Of the original 1050 contacts, 54 were dead. The various groups are listed in Table 11. The groups are so small that little can be said. There is an assumption that must be made: all patients flash-burned below 1000 meters undoubtedly had some gamma radiation. At the present time ABCC is making a detailed analysis of all deaths occurring in Hiroshima since the atomic explosion. It is from this analysis that the answer to the question posed previously will be found. One other attempt was made for a partial answer. The

調査検討しなければならない今一つの問題がある．即ち，放射線傷害及び熱傷を有する1000ｍ以内で被爆した群は，機械的傷害又は無傷害群よりも，より急速な割合で死亡していたかどうか．斯る仮説が，実証され得るかどうかを，調べて見ようとして，ＭＥ－55研究計画に属する1000ｍ以内の被爆群の全死亡例が蒐集された．1050名中，54名が死亡したが，其の詳細は表11に記録されている．その各群は，余り小さいので確定的なことは殆んど云えない．1000ｍ以下で熱傷を受けた対象者全員は，疑いもなくある程度のγ線を受けていたという仮定は提示せねばならない．現在ＡＢＣＣは，原子爆発以来広島で発生する全死亡者の詳細なる解析を実施中である．この解析によつて先の質問に対する解答が得られるであろう．従つてこれに対する部分的な解答を得るために別個の検討をして見た．即ち，Metropolitan 生命保険会社に，テ

Metropolitan Life Insurance Company was asked about the death rates of survivors from the Texas City disaster, the Coconut Grove fire and severe automobile accidents. Their reply was that they had no information available and did not know of any group that might have such information. It would be of interest to know the effect of flash alone or with radiation injury on survival rates.

SUMMARY

Atomic bomb victims who were exposed under 1000 meters and survived over five years were reinvestigated. There were 619 patients who comprised a total sample.

Mechanical, blast, burn and radiation injuries were evaluated as to onset, duration, severity, body area affected and type of healing. The modal patient experienced severe radiation and mild trauma.

Results were compared with similar earlier studies. The question emerges as to the possibility that patients exposed within 1000 meters with radiation and/or thermal injuries have been dying at a faster rate than those with mechanical or no injuries.

A short history of the development of the Atomic Bomb Casualty Commission is included.

キサス市の災害，Coconut Grove の火災，及び無残な自動車事故による死亡率について照会したが，同社は，提供し得る資料はなく，斯る資料を有するものと思われるグループは知らない旨，返答した．放射線傷害を伴う場合と伴なわない場合の閃光効果と生存率との関係を究明することは興味深いことである．

要約

爆心地より1000ｍ以下で被爆し５年以上生存した被爆者に対し再検討した．この研究に利用した対象者は 619 名であつた．

機械的傷害，爆風傷害，火傷，及び放射線傷害を発現，持続期間，程度，傷害部位，及び治癒経過等について検討された．対象者のモードは強度な放射線及び軽度の外傷を受けた．

諸結果は，初期の類似の研究と比較された．1000m 以内で被爆して放射線傷害又は熱傷を受けた群は，機械的障害又は障害のない群団よりも，より急速な割合で死亡していたのではないかという可能性について問題が起きた．

原爆傷害調査委員会の経緯を簡単に述べた．

REFERENCES
参考文献

1. Oughterson, A. W. et al.: Medical Effects of Atomic Bomb; the report of the Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan. Oak Ridge, Tennessee, U.S.A.E.C., 1951. Six volumes.
(原子爆弾の医学的影響)

2. Medical Report on Atomic Bomb Effects. Medical Section, Special Committee for the Investigation of the Effects of the Atomic Bomb. The National Research Council of Japan. Tokyo, Nankodo, 1953.
(原子爆弾の影響に関する医学的報告)

3. U.S. Strategic Bombing Survey, Medical Division. The Effects of Atomic Bombs on Health and Medical Services in Hiroshima and Nagasaki. Washington, D.C., Govt. Print. Off., 1947.
(広島及び長崎における保健及び医療機関)

4. Los Alamos Scientific Laboratory. The Effects of Atomic Weapons. Washington, D.C., Govt. Print. Off. Revised September, 1950.
(原子兵器の効果)

5. British Mission to Japan. The Effects of the Atomic Bombs at Hiroshima and Nagasaki. Oak Ridge, Tennessee, U.S.A.E.C., Technical Information Division. NP-1156, 1946.
(広島及び長崎における原子爆弾の影響)

6. 羽田野 茂: (Hatano, S.): 原子爆弾熱傷. 臨床 103－118, 1953.
(On the burns by the A-bomb. Rinsho 6: 103-118, 1953.)

7. Snell, F. M.: A Survey of 501 Survivors of the Hiroshima Atomic Bomb Explosion. Report submitted to Bureau of Medicine and Surgery, USN, September 3, 1947.
(広島原子爆弾の 501名の被爆生存者調査)

8. 江崎治夫, (Ezaki, H.) 藤浪 武, (Fujinami, T.) 宇根本政之, (Unemoto, M.) 河石 浩 (Kawaishi, H.) 中高下公四郎, (Nakakoge, K.) and 佐々木甲子郎: (Sasaki, K.)
広島における原子爆弾被爆者, 殊に火傷性瘢痕を主症状とする人々の7年後における全身症状について
—外科的方面, 広島医科大学, 1953.
(General symptoms of A-bomb exposed patients in Hiroshima, especially those with flash burns as a cardinal symptom seven years after A-bombing. Surgical study, Hiroshima Medical College, 1953.)

9. 座談会: 原爆の思い出を語る. 広島逓信病院, 1952. 3.
(Hiroshima Communications Hospital (Japan) Symposium of Exposed Survivors held in Hiroshima on March 28, 1952. Oak Ridge, Tennessee, U.S.A.E.C., Technical Information Service. NYO-4457, 1953.)

10. Lawson, D. I.: Fire and the Atomic Bomb. Fire Research Bulletin No. 1. London, Her Majesty's Stationery Office, 1954.
(火災及び原子爆弾)

11. Genetic Conference, Committee on Atomic Casualties, National Research Council. Genetic effects of the atomic bombs in Hiroshima and Nagasaki. Science 106: 331-333, 1947.
(広島及び長崎における原爆の遺伝的影響)

12. ABCC Dept. of Biostatistics, Basic tabulations of medical data ME-55 adult medical program. Hiroshima, ABCC.
(ＭＥ－55成人医学研究計画に基づく医学的資料の基本的製表)

13. Kastenbaum, M. A. Statistical analyses of ABCC studies 1950-1953. Hiroshima, ABCC. 1954.
(1950－1953年ＡＢＣＣ研究調査の統計学的解析)

14. Churchill, E. D. Cited by Beebe, G. W. and DeBakey, M. C. p. 86 reference 15.

15. Beebe, G. W. and DeBakey, M. C.: Battle Casualties. Springfield, Ill., Charles C. Thomas, 1952.
(戦闘による傷害)

16. Holmes, R. H., Enos, W. F. Jr., and Bayer, J. C.: Demarcation of body regions battle casualty analysis. U.S. Armed Forces Med. J. 5: 1610-1618, 1954.
(人体部位の区分及び戦闘傷害の解析)

17. Pearse, H. E. and Kingsley, H. D.: Thermal Burns from the Atomic Bomb. USAEC unclassified report, UR 254, 1953.
(原子爆弾による熱傷)