TECHNICAL REPORT
18-59
業 績 報 告 書

BRACHYPHALANGISM AND BRACHYMETAPODIA OF THE HAND

A RADIOLOGICAL STUDY

手 の 短 節 骨 症 及 び 短 中 手 骨 症

放 射 線 学 的 研 究

ARTHUR W. PRYDE, M.D.

TAKASHI KITABATAKE, M.D. (北畠 隆)

ATOMIC BOMB CASUALTY COMMISSION
ABCC

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ARTHUR W. PRYDE, M.D.[1]

TAKASHI KITABATAKE, M.D.[2](北畠 隆)

From the Department of Radiology, ABCC[1]
and Department of Radiology, Nagoya University Medical School[2]

ＡＢＣＣ放射線科[1]，名古屋大学医学部放射線医学教室[2]

ATOMIC BOMB CASUALTY COMMISSION
Hiroshima - Nagasaki, Japan

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INTRODUCTION

Since early in this century hand anomalies such as polydactyly, syndactyly and brachydactyly have been well known entities not only genetically but also radiologically. However, there are relatively few reports concerning brachydactyly of only a single phalanx or metacarpal, particularly concerning the frequency and distribution of such abnormalities.

The Atomic Bomb Casualty Commission (ABCC), in collaboration with the National Institute of Health of Japan, has been studying the delayed effects of the atomic bomb on the exposed population in Japan with a suitable control group. As part of the pediatric program, a routine roentgenogram was made of the left hand of each patient. Using data derived from these roentgenograms a study has been made of the occurrence of brachyphalangism and brachymetapodia in a single phalanx or metacarpal with particular reference to the middle phalanx of the little finger, the terminal phalanx of the thumb and the fourth and fifth metacarpals as seen radiographically in healthy Japanese children. A comparison was made of the frequency of the same variants seen in children exposed in utero to the atomic bomb in Hiroshima. All studies were made on the left hand.

METHODS AND MATERIALS

For this study 2932 clinically normal, healthy Japanese children were used consisting of three groups. The first (Group I) consisted of 2539 children from 6 to 19 years of age, 1302 boys and 1237 girls, all of whom either live or have lived in Hiroshima, but who were not exposed to the atomic bomb. (Table 1) This group was examined to determine the normal frequency of the variants studied in the healthy Japanese children. Group II included 219 children of exposed mothers who were at different stages of

緒言

本世紀の初めより多指症，合指症，及び短指症の様な手指の奇形は，遺伝的ばかりでなく，放射線学的にも，よく知られている異常である．しかしながら，単一の節骨又は中手骨の短指症につき，特に斯る異常の出現頻度及び分布に関する報告が比較的に少ない．

原爆傷害調査委員会（ＡＢＣＣ）は厚生省国立予防衛生研究所と協力して，日本の被爆集団における原爆の遅発性影響を，適切な対照群と共に調査している．小児科の研究計画の一環として，各小児の左手の通常Ｘ線写真を撮つた．これらのＸ線写真を資料として，健康な日本の小児における第５指中節骨，拇指の末節骨及び第４第５中手骨につき，単一の節骨又は中手骨の短節骨症及び短中手骨症の頻度を放射線学的に検討した．広島において胎内で原子爆弾に遭遇した小児における同様な異常の出現頻度につき比較検討した．尚，Ｘ線検査は全部左手に対して行なつた．

検査方法及び検査対象

この検索には，３群よりなる臨床的に健康な日本人小児2932名が用いられた．第Ⅰ群は６才より19才に至る小児で，男子 1302名，女子1237名，計2539名であり，その何れも広島に住んでいたことがあるか，又は現在住んでいるが，原爆には遭遇しなかつた．（表１）　日本の健康児における斯る異常の正常頻度を決定するため本群を検査した．第Ⅱ群は，1945年８月６日広島市の原子爆弾爆発時，被爆母親の胎内で，種々異つた発育段階にあつた小児 219名を含む．この群は，更に被爆

intra-uterine development at the time of the explosion of the atomic bomb over Hiroshima on August 6, 1945. This group was further subdivided into two subgroups based on the intra-uterine age at the time of exposure. Thus subgroup IIA included those children born after January 1, 1946 and who were exposed in the early half of pregnancy, and subgroup IIB were the children born on or before January 1, 1946 and who were exposed in the latter half of pregnancy. Group III included 174 children who were also intra-utero on August 6, 1945 but whose mothers were not in Hiroshima at that time. These also were subdivided according to whether they were in the first or last half of gestation and were used as additional controls of Group II. In Table 2, patients of Group II and III were classified according to sex, exposure distance from the hypocenter, gestation stage and number of children examined. Each child in Group I was examined radiographically within two weeks of his birthday several times between 1951 and 1956, and the films of one or more years were used in this study. In Group II the films used were only those of the examination in 1953 when the children exposed in the first half of gestation were 7 years old, and the children exposed in the last half of gestation were 8 years old.

時の妊娠月令による2つの小群に分類された．従つて小群ⅡAは，妊娠前半期に被爆し1946年1月以後に出生した小児から成り，小群ⅡBは，妊娠後半期に被爆し1946年1月以前に出生した小児を含む．第Ⅲ群は，1945年8月6日広島には居なかつた母親の胎内に居た174名を含む．これらも，妊娠前半期，又は，後半期にあつたかどうかに因り分類され，第Ⅱ群の追加非被爆対照児として用いられた．表2においては，第Ⅱ及び第Ⅲ群の小児を，年令，爆心地よりの被爆距離，妊娠月令及び被検数別に分類した．第Ⅰ群の小児は，1951—1956年の間に数回，各自の誕生日前後2週間以内にX線検査を受け，この研究では，1年以上の間に撮つたX線写真を用いた．　第Ⅱ群においては，使用したX線写真は，1953年に実施した検査の写真のみであり，妊娠前半期の被爆小児は7才であり，妊娠後半期の被爆小児は8才であつた．

TABLE 1　CHILDREN EXAMINED BY AGE AND SEX (GROUP I - CONTROLS)

表1　年令及び性別による被検児（第Ⅰ群—対照）

AGE 年令	BOYS 男子	GIRLS 女子	TOTAL 合計
6	126	121	247
7	124	107	231
8	125	105	230
9	103	112	215
10	93	114	207
11	105	101	206
12	108	102	210
13	99	66	165
14	81	92	173
15	84	85	169
16	63	71	134
17	73	64	137
18	57	47	104
19	61	50	111
TOTAL 計	1302	1237	2539

To avoid bias during the study of the roentgenograms used in this study, the identity of the patients was not known to the examining radiologist. After the roentgen findings had been determined, they were then correlated with other pertinent data.

本研究に使用したX線写真の検討中，偏りを避けるため，被検者の分類は，検討に当つた放射線専門医には伏せておいた．X線検査所見確定後，これらを，他の適切な資料と相関関係につき検討した．

TABLE 2 CHILDREN EXPOSED IN-UTERO TO THE ATOMIC BOMB AND NON-EXPOSED CONTROLS (GROUP II & III)

表2 胎内被爆児及び非被爆対照児（第Ⅱ及び第Ⅲ群）

SEX 性	FIRST HALF OF GESTATION (7 YEAR-OLD CHILDREN) 妊娠前半期群（7才の小児）					SECOND HALF OF GESTATION (6 YEAR-OLD CHILDREN) 妊娠後半期群（6才の小児）					ALL IN-UTERO 胎内児総数				
	EXPOSURE 被爆			NON-EXP. 非被爆	TOTAL 計	EXPOSURE 被爆			NON-EXP. 非被爆	TOTAL 計	EXPOSURE 被爆			NON-EXP. 非被爆	TOTAL 計
	<2000m	>2000m	TOTAL 計			<2000m	>2000m	TOTAL 計			<2000m	>2000m	TOTAL 計		
BOYS 男子	20	49	69	61	130	21	20	41	28	69	41	69	110	89	199
GIRLS 女子	19	46	65	63	128	23	21	44	22	66	42	67	109	85	194
TOTAL 計	39	95	134	124	258	44	41	85	50	135	83	136	219	174	393

RESULTS

Normal children

Brachymesophalangism was studied in the patients of Group I. In 1302 boys there were 192 cases or 14.7 per cent and in 1237 girls there were 262 cases or 21.2 per cent. (Table 3) A Chi-square calculation revealed that: $\chi^2 = 17.773$ with one degree of freedom, yielding a $p < 0.01$ which indicated definitely a significant difference between sexes with regard to this anomaly. No significant differences were found between sexes with respect to the different degrees of shortening of the middle phalanx.

In classifying the cases of brachymesophalangism. we have used two criteria; (a) irregularity of the metaphysis, epiphyseal line and epiphysis and (b) shortening of the phalanx. A phalanx was considered short if the total length from the distal end of the diaphysis to the proximal end of the epiphysis of the middle

検査結果

正常児

第Ⅰ群の被検者において，**短中節骨症**が検討された．男子1302名の中，192例即ち14.7％，女子1237名中，262例即ち21.2％であつた（表3）．χ^2 検定の結果，自由度が1の場合 $\chi^2 = 17.773$ で，$p < 0.01$ となり，この異常につき，両者の間に明らかに有意の差が認められる．中節骨の短縮については，男女間に何等有意の差は認められなかつた．

短中節骨症の症例分類に当つて2つの基準を用いた．即ち（a）骨端中節，骨端線，及び骨端の不整 （b）節骨の短縮．もし骨幹の遠位末端より中節骨の骨端の近位末端に至る全長が，末端節骨上におけると同様な距離と同等乃至は小ならば，節骨は短かいものと考えられた．この検索

phalanx was the same or less than a similar distance on the terminal phalanx. For this study we have classified all cases into four degrees. The first degree of brachyphalangism (+) was defined as the middle phalanx with slight abnormality in shape and density in and/or near the epiphyseal center and line. The second degree (++) consisted of irregularity, a little more noticeable than the first degree and/or slight shortening of the phalangeal length. In the third degree (+++) the middle phalanx showed moderate shortening in length, with or without appreciable deformity in the epiphyseal region. The fourth degree (++++) included cases of shortening more than the third degree, with or without deformity, or the epiphysis may be absent.

に対し全症例を４段階に分けた．短節骨症第１度（＋）とは，中節骨の骨端核及び骨端線又はその近辺の黒化及び形状に軽度の異常があるものをさす．第２度（＋＋）は第１度よりも更に幾分顕著な不整乃至節骨の僅かな短縮を示す．第３度（＋＋＋）においては，中節骨に，骨端部の感知し得る程の変形を伴い，又は，伴わない中等度の短縮を認める．第４度（＋＋＋＋）には，変形を伴い，又は，伴わない３度よりも強い短縮があり，あるいは骨端が欠如しているものが含まれる．

TABLE 3 PRESENCE OF BRACHYMESOPHALANGISM OF LEFT LITTLE FINGER NORMAL JAPANESE CHILDREN (GROUP I)

表３　正常な日本人小児の左手小指に観察される短中節骨症（第Ⅰ群）

SEX 性	TOTAL EXAMINED 被検全数	CHILDREN WITH BRACHYMESOPHALANGISM 短中節骨症のある小児					
		DEGREE OF BRACHYPHALANGISM 短節骨症の程度				TOTAL 計	
		+	++	+++	++++	NUMBER 例数	PER CENT OF TOTAL EXAMINED 被検全数の百分率
BOYS 男子	1302	43	42	55	52	192	14.7
GIRLS 女子	1237	60	65	70	67	262	21.2
TOTAL 計	2539	103	107	125	119	454	17.9

Length ratios of the middle and terminal phalanges of the little finger were determined in 120 children with normal phalanges and in 75 children with brachymesophalangism in ages from 6 to 19. (Table 4) There was only slight difference in the length ratios in the normal finger and that of first degree shortening. Increasing difference was noted as the degree of deformity increased. Occasional exceptions occurred in which a few middle phalanges showing no epiphyseal change were 1 to 2 mm. shorter than the terminal

第５指の中節骨及び末節骨の長さの比率は，６才より19才までの者で，正常節骨を有する小児120名及び短中骨節症を有する小児75名において決定された．（表４）　正常な節骨の長さの比率と第１度短縮の節骨の長さの比率との間には，極く僅かの差異があつた．　変形度が進むに従い，差異の増加を認めた．ときおり例外があつた．即ち，骨端の変化を示さない少数の中節骨は，末節骨よりも１－２㎜短かく，他方判然と認識し得る骨端の変化を示す若干の中節骨は，末節骨よりも

phalanx while some middle phalanges showing distinguishable epiphyseal change were 2 to 3 mm. longer than the terminal phalanx. No particular relationship was noted between the age and the length proportion of the two phalanges studied.

2－3㎜長かつた．年令及び検討した2種の節骨との間には，何等特別の関係はなかつた．

TABLE 4 LENGTH RATIO OF MIDDLE AND TERMINAL PHALANGES OF LITTLE FINGER COMPARISON OF NORMAL HANDS AND THOSE WITH BRACHYMESOPHALANGISM

表4 小指の中節骨及び末端節骨の長さの比；正常な手及び短中節骨症の比較

	NORMAL CASES WITHOUT SHORT PHALANGES 短中節骨のない正常例	SHORT MIDDLE PHALANX OF THE LEFT LITTLE FINGER 左手小指の短中節骨				
		＋	＋＋	＋＋＋	＋＋＋＋	AVERAGE 平均
NUMBER OF CASES MEASURED 測定症例数	120	18	15	25	17	75
PROPORTION 比 率	1:1.09	1:0.98	1:0.95	1:0.85	1:0.76	1:0.88

Brachytelephalangism (short terminal phalanx of the left thumb) frequency was determined in the children of Group I. In 1302 boys there were 27 cases (2.1 per cent) and in 1237 girls there were 36 cases (2.9 per cent). The difference in percentages was tested by Chi-square, yielding the following results: $\chi^2 = 1.828$, $9.1 < p < 0.2$, thereby showing no significant difference between boys and girls. The length of the affected phalanx was normal, or nearly so, before closure of the epiphysis which usually occurred about one to two years earlier than in the normal phalanx. The relative shortening became obvious one to two years after the epiphyseal closure. Early epiphyseal closure was also seen in some cases of brachymesophalangism.

短末節骨症（左拇指の短い末節骨）の頻度は，第Ⅰ群の小児において決定された．男子1302名の中，27症例（2.1％），女子1237名の中，36症例（2.9％）があつた．百分率の差についてχ^2検定を行なつて，次の結果が得られた．即ち，$\chi^2 = 1.828$，$9.1 < p < 0.2$で，男女間には，何等有意の差は認められなかつた．正常節骨におけるよりも大抵約1－2年早く生じる骨端核融合前では短縮した節骨の長さは，正常乃至殆んど正常であつた．骨端核融合1－2年後に，相対的短縮が顕著となつた．若干の短中節骨症においても，早期骨端核融合を観察した．

Length ratios between phalanges of the thumb in normal children were 1 to 1.2-1.4 with the terminal phalanx as one irrespective of the child's sex or age (6 to 19 years). However, in the 63 cases of brachytelephalangism reported above, the ratio became 1 to 1.5 in 11 and 12 year old children increasing to about 1 to 1.7 in children over 14 years of age.

正常児における拇指節骨間の**長さの比率**は，末端骨折値を1とした場合，小児の性又は年令（6－19才）に関係なく1より1.2－1.4であつた．しかしながら上述の短末節骨症の63症例ではこの比率は，11才及び12才の小児において1より1.5となり，14才以上の小児においては1より約1.7に増加した．

Comparing lengths of normal terminal phalanges of each finger, that of the thumb was the longest with the ring, middle, index and little fingers following in order. In brachytelephalangism the sequence in decreasing length of terminal phalanx became ring, middle, thumb, index and little finger in children over about 12 years of age. Occasionally the terminal phalanx of the thumb may be the shortest of all.

各指の正常末節骨の長さを比較するに，拇指が最も長く，それに次いで薬指，中指，食指，及び小指の順であつた．短末節骨症においては末節骨の長さの減少の順序は，約12才以上の小児では，薬指，中指，拇指，食指，及び小指となつた．時々拇指の末骨節が，指の中で最も短かいことがあり得る．

A relationship between brachymesophalangism of the left little finger and telephalangism of the thumb within each sex is suggested by the following consideration. As mentioned, brachymesophalangism was normally found in about 14 per cent of boys and 21 per cent of girls. However, in 22 boys and 32 girls with brachytelephalangism there were 7 (32 per cent) and 12 (38 per cent) cases respectively of brachymesophalangism. Contingency tables were made to check a possible association in the occurrence of these, and Chi-square computations yielded the following values:

男女間における左小指の短中節骨症及び拇指の短末節骨症の関係は，以下の考按により示唆される．言及した如く短中節骨症は，普通約14%の男子及び21%の女子に発見された．しかしながら短末節骨症を有する男子22名及び女子32名では，短中節骨症例はそれぞれ7名（32%）及び12名（38%）であつた．これらの出現の関係を検討するため分割表を作成してχ^2検定を行なつた結果次の数値が得られた．

Boys 男子 $\chi^2 = 5.188$ $\therefore 0.02 < p < 0.05$

Girls 女子 $\chi^2 = 5.241$ $\therefore 0.02 < p < 0.05$

This is significant at the 5 per cent level but not at the 1 per cent level, thereby suggesting rather than confirming the existence of a relationship.

これは5%有意水準では有意であるが，1%有意水準では有意ではないので関係があることを確認するというよりも示唆するということである．

Brachymetapodia was seen in 11 cases in the 2539 children of Group I, 3 cases (0.2 per cent) in boys and 8 cases (0.6 per cent) in girls. This occurred in the first, fourth and fifth metacarpals with one, three and seven instances respectively. Regardless of age and sex of the child the length ratio of the terminal, middle and proximal phalanges and the metacarpal of the left fourth digit was approximately 1:1.3:2.2:3.0 and of the fifth digit 1:1.1:1.8:2.4. In brachymetapodia the ratios became 1:1.3:2.2:2.3 and 1:1.1:1.8:1.8.

短中手骨症は第Ⅰ群の小児2539名中，11症例の男子では3例（0.2%），女子では8例（0.6%）が発見された．これは第1中手骨に1例，第4中手骨に3例，第5中手骨に7例とそれぞれ発現した．小児の性及び年令に関係なく，左第4指の末節骨，中節骨，基節骨，及び中手骨の長さの比率は，約1：1.3：2.2：3.0及び第5指骨のそれ等の比率は1：1.1：1.8：2.4であつた．短中手骨症においては，それ等の比率は1：1.3：2.2：2.3及び1：1.1：1.8：1.8であつた．

Children Exposed to the Atomic Bomb While Intra-utero

Brachymesophalangism incidence was determined in the 219 exposed children (Group II) and the non-exposed control children (Group III). The distribution is shown in Table 5. No statistically significant difference was detected in the incidence between the exposed and non-exposed children examined.

Bone maturation studies showed only slight difference (Table 6) between boys and girls, exposed and non-exposed in the first and last half of gestation or among the proximally or distally exposed and no statistically significant difference could be demonstrated between the children with brachymesophalangism and those without. These were based on standards of Japanese children developed by the Atomic Bomb Casualty Commission and reported by Sutow.[21]

胎内被爆児

短中節骨症の発現率は，被爆小児（第Ⅱ群）219名及び非被爆対照小児（第Ⅲ群）において判定された．その分布は表5に示す．被爆及び非被爆被検小児間の発現率には，統計学的に何等有意の差は検出されなかつた．

骨格成熟観察において，被爆及び非被爆の妊娠前半期群及び後半期群の，又は近距離被爆及び遠距離被爆の男女との間には，僅かな差のみを認め，短中節骨症を有する小児と然らざる小児との間には，統計学的に有意の差は認められなかつた（表6）．これらは，ＡＢＣＣにおいて設定されSutow[21]によつて発表された日本人小児の標準に従つた．

TABLE 5 PRESENCE OF BRACHYMESOPHALANGISM OF LEFT LITTLE FINGER AMONG CHILDREN EXPOSED IN-UTERO (GROUP II) AND NON-EXPOSED CONTROLS (GROUP III)

表5 胎内被爆児（第Ⅱ群）及び非被爆対照児（第Ⅲ群）の小指の短中節骨症の存在

GESTATION PERIOD 妊娠期間		EXPOSURE 被爆群 <2,000 m TOTAL EXAMINED 被検全数	<2,000 m ANOMALY PRESENT 奇形のあるもの NUMBER 例数	<2,000 m %	>2,000 m TOTAL EXAMINED 被検全数	>2,000 m ANOMALY PRESENT 奇形のあるもの NUMBER 例数	>2,000 m %	NON-EXPOSED 非被爆群 TOTAL EXAMINED 被検全数	NON-EXPOSED ANOMALY PRESENT 奇形のあるもの NUMBER 例数	NON-EXPOSED %
BOYS 男子	FIRST HALF 前半期群	20	2	10.0	49	7	14.3	61	9	14.8
	SECOND HALF 後半期群	21	5	23.8	20	4	20.0	28	4	14.3
	TOTAL PERIOD 期間合計	41	7	17.1	69	11	15.9	89	13	14.6
GIRLS 女子	FIRST HALF 前半期群	19	9	47.4	46	12	26.1	63	11	17.5
	SECOND HALF 後半期群	23	5	21.7	21	6	28.6	22	8	36.4
	TOTAL PERIOD 期間合計	42	14	33.3	67	18	26.9	85	19	22.4
ALL 全	FIRST HALF 前半期群	39	11	28.2	95	19	20.0	124	20	16.1
	SECOND HALF 後半期群	44	10	22.7	41	10	24.4	50	12	24.0
	TOTAL PERIOD 期間合計	83	21	25.3	136	29	21.3	174	32	18.4

TABLE 6 AVERAGE BONE AGE, CHILDREN EXPOSED TO THE ATOMIC BOMB WHILE INTRA-UTERO AND CONTROLS (GROUPS II & III)

表6 胎内被爆児及び対照児の平均骨骼年令（第Ⅱ及び第Ⅲ群）

EXPOSURE 被爆		SHORT MIDDLE PHALANX 短中節骨	BOYS 男子 NUMBER EXAMINED 被検児数	BOYS 男子 MEAN BONE AGE 平均骨骼年令	BOYS 男子 S.D. 標準偏差	GIRLS 女子 NUMBER EXAMINED 被検児数	GIRLS 女子 MEAN BONE AGE 平均骨骼年令	GIRLS 女子 S.D. 標準偏差
A. CHILDREN EXPOSED IN THE FIRST HALF OF GESTATION (SUBGROUP IIA)								
A. 妊娠前半期の被爆児（小群ⅡA）								
GROUP II A 第Ⅱ群A	<2000 m	ABSENT 無	18	6.74	0.78	10	7.01	0.84
		PRESENT 有	2	7.00	0.35	9	6.83	0.61
	>2000 m	ABSENT 無	42	6.83	0.78	34	6.86	0.82
		PRESENT 有	7	6.82	0.54	12	6.89	0.39
CONTROL (NON-EXPOSED) GROUP III 対照（非被爆）第Ⅲ群		ABSENT 無	52	6.78	0.91	52	7.14	0.84
		PRESENT 有	9	6.38	0.42	11	6.86	0.36
B. CHILDREN EXPOSED IN THE LAST HALF OF GESTATION (GROUP II B)								
B. 妊娠後半期の被爆児（第ⅡB群）								
GROUP II B 第Ⅱ群B	<1600 m	ABSENT 無	15	7.64	0.97	18	8.30	0.79
		PRESENT 有	5	7.20	0.71	5	7.30	0.91
	3000 - 4000 m	ABSENT 無	16	7.54	0.88	15	8.32	1.00
		PRESENT 有	4	7.00	0.70	6	7.67	0.81
CONTROL (NON-EXPOSED) GROUP III 対照（非被爆）第Ⅲ群		ABSENT 無	23	7.93	0.92	16	7.98	0.82
		PRESENT 有	4	7.81	0.32	8	7.72	0.61

DISCUSSION

Since Farabee[2] reported a pedigree of brachydactyly in which conformity to the Mendelian law was demonstrated, many papers concerning genetic and morphologic aspects of brachydactyly and brachyphalangism have been published by Vidal, Drinkwater, Lewis, Mohr, Wright, etc.[1-5] However, these studies deal mainly with brachydactyly seen in more than two fingers or in association with other finger anomalies as hyperphalangism or synarthrosis. A general classification of brachydactyly has been made by Cocchi.[1] Brachymesophalangism in association with other developmental

考按

Farabee[2] が Mendelの法則に一致するものと立証された短指症の一家系について報告して以来短指症及び短節骨症の遺伝的及び形態学的面に関し，Vidal, Drinkwater, Lewis, Mohr, Wright 等々[1-5]が多くの報告を発表してきた．しかしこれらは，2指以上又は節骨過長又は骨不動結合の如き他の指の奇形の関連において，観察された短指症を主として調査したものである．Cocchi[1] は短指症の総括的分類を行なつた．Schmidt と Junker[9] 及び Rochlin と Schirmunsky[14] は，他の発育上の異常に関連して短中節骨症につき報告した．

variants has been reported by Schmidt and Junker[9] and Rochlin and Schirmunsky.[14] Brachymesophalangism unassociated with other abnormalities was followed through five generations by Sachs[11] in which a dominant inheritance was considered to be present. A short middle phalanx of the little finger is found in one per cent of normal children according to Caffey and this percentage may be increased in mongolism, cretinism or achondroplasia.

Sachs[11] は，他の異常と関連性のない短中節骨症につき，５世代に亘り継続観察し，それに優性遺伝が存在したものと考えた．Caffey によると，第５指の短中節骨は，正常児の１％に見られ，この頻度はモンゴリズム病，クレチン病，又は軟骨形成不全においては，増加するかも知れないという．

The incidence of brachymesophalangism of the little finger reported here is a little higher than that reported by other authors. This discrepancy may be a racial difference since many authors recognize it as a dominant hereditary anomaly. Difference in standards of criteria may be significant. In studying a large number of hands, the authors have felt that the irregular epiphysis and metaphysis and the shortening of the phalanx are not entirely separate processes but that they are different degrees or variants of the same developmental defect, and therefore, should be grouped together. Many times phalanges which had an irregular epiphysis or diaphysis showed no abnormality after closure of the epiphysis and therefore, if classified later after epiphyseal closure would be considered normal in the absence of actual shortening.

ここに報告した第５指の短中節骨症の発現率は，他の著者等により報告された率よりも少し高率である．多くの研究者は，それが優性遺伝的奇形と認めているので，この異常は人種的差異によるものかも知れない．判定基準の相違が，有意であるかも知れない．多数の指骨の検索において，不規則な骨端及び骨端中節，及び節骨の短縮化は，全く別個の過程ではないが，それらは同一の発育欠損の異つた程度乃至は異常であり，従つて，一緒にまとめて分類すべきであると著者等は思考する．不規則な骨端乃至は骨幹を有する節骨は，骨端核融合後，何等異常を呈さなかつたことが屢々あつた．従つて，骨端核融合後に分類されたならば，節骨は事実上の短縮化がないので，正常と考えられる．

The higher incidence of brachymesophalangism agrees with the findings of Drinkwater and others who indicate a higher frequency among females than males in the same pedigree. While delayed skeletal maturation is not uncommon where other important developmental anomalies coexist with brachymesophalangism, the authors found no indication of delayed skeletal maturation when brachymesophalangism existed alone. The lack of demonstrable difference between the children exposed to the atomic bomb while intra-utero and the control children is reported as a negative finding as part of a large survey study.

短中節骨症のより高い発現率は，Drinkwater 等の所見，即ち，同一家系においては男性よりも女性により高率の発現率を示すという所見と一致する．他の重要な発育上の異常が短中節骨症と共在している場合，遅発性骨骼成熟は稀なことではないが，短中節骨症のみがある場合，著者等は何等遅発性骨骼成熟の徴候を見出さなかつた．広範囲な調査の結果，胎内被爆児及び非被爆児間に立証し得る差異がないので異常所見はないと報告する．

The brachytelephalangism incidence of 1.5 per cent reported by Pfitzner[4] of an unidentified age and racial group is similar to our findings. The length ratio of the terminal phalanges of the thumb as reported by Thomsen[18] was 0.70 to 0.75 with the normal proximal phalanx as 1. In brachytelephalangism this ratio became 0.6 to 1. This is a little higher than the 0.5 or 0.4 to 1 found in our series. Brachymetapodia is referred to very seldom in the many reports studied.

Pfitzner[4] は不確認の年令及び人種群中，短末節骨症の発現率１．５％と報告したが，これは我々の所見と同様である． Thomsen[18] は，拇指の末節骨の長さの比率は，正常な近位節骨を１とした場合，０．70－０．75であると報告した．短末節骨症においては，この比率は，０．６－１になつた．これは我々の被検群で発見した１：０．５乃至０．４よりも，僅かに高値である．多くの報告で短中手骨に言及したものは極めて稀である．

SUMMARY

1. Left hand roentgenograms were studied of Japanese children of Hiroshima divided into three groups; Group I was 1302 male and 1237 female normal, healthy controls; Group II was 219 children exposed to the atomic bomb on August 6, 1945 while still intra-utero; Group III was 174 non-exposed control children who were intra-utero on August 6, 1945.

2. Brachymesophalangism of the left little finger was found in the control children in 14.13 per cent of males and 21.26 per cent of females when epiphyseal irregularity as well as actual shortening is considered as a criterion.

3. Incidence of brachymesophalangism of the left little finger was not significantly different for children exposed to the atomic bomb while intra-utero.

4. Bone age of children with brachymesophalangism and those exposed to the atomic bomb while intra-utero showed no difference from the normal.

5. Brachytelephalangism of the thumb occurs in 2.1 per cent of normal boys and in 2.9 per cent of normal girls.

総括

１．次の３群に分類した広島の日本人小児の左手Ｘ線写真を検討した．即ち，第Ⅰ群は男子1302名，女子1237名の健常対照児．第Ⅱ群は，1945年８月６日胎内で，被爆した小児 219名．第Ⅲ群は，1945年８月６日胎内にいた非被爆対照児 174名であつた．

２．骨端の不規則性並びに実際の短縮を基準として考慮する場合，左手第５指の短中節骨症が対照児において男子14．13%，女子21．26%に見出された．

３．胎内被爆児に関しては，左手第５指の短中節骨症の発現率には，有意の増加はなかつた．

４．短中節骨症のある小児の骨年令及び胎内被爆児のそれは，正常児の骨年令に比し差異は認められなかつた．

５．拇指の短末節骨症の発現は，正常男子 2.1％正常女子 2．9 %である．

6. A possible relation between brachymesophalangism of the little finger and brachytelephalangism of the thumb occurring in the same child is suggested by an association significant at the 5 per cent level.

7. Brachymetapodia occurred in 0.2 per cent of normal boys and 0.6 per cent in girls and was seen most often in the fifth metacarpal.

6．同一小児に発現する第５指の短中節骨症及び拇指の短末節骨症との間の関係については，５％有意水準において有意であつたので両者の間には関係があると思われる．

7．短中手骨症の発生は，正常男子０．２％，女子０．６％であり，これは第５中手骨に最も屡々観察された．

REFERENCES
参考文献

1. Schinz, H. R., Baensch, W. E., Friedl, E., and Uehlinger, E.: Roentgen-Diagnostics. New York, Grune and Stratton, 1951-1954.

   (レントゲン一診断学)

2. Gates, R. R.: Human Genetics, 2 Vols., New York, MacMillan, 1946.

   (人類遺伝学)

3. Brailsford, J. F.: Radiology of Bones and Joints, 5th Ed. Baltimore, Williams and Wilkins, 1953.

   (骨骼及び関節に関する放射線学)

4. Kohler, A., et al.: Borderlands of the Normal and Early Pathologic in Skeletal Roentgenology, 10th Ed., New York, Grune and Stratton, 1956.

   (骨骼レントゲン学における正常像及び初期病的像の限界)

5. Caffey, J. P.: Pediatric X-Ray Diagnosis, 3rd Ed. Chicago, Yearbook Pub., 1956.

   (小児のX線診断)

6. Bunnell, S.: Surgery of the Hand, 3rd Ed., Philadelphia, Lippincott, 1956.

   (手の外科学)

7. Shoul, M. I. and Ritvo, M.: Roentgenologic and clinical aspects of hyperphalangism (polyphalangism) and brachydactylism; hereditary abnormal segmentation of the hand. New England J. Med. 248:274-278, 1953.

   (節骨過長症 (指趾過剰症) のX線学的及び臨床的面; 手の遺伝的異常分節)

8. Brailsford, J. F.: Developmental abnormalities of the skeleton. Brit. J. Radiol. 9:239-271, 1936.

   (骨骼の発育異状)

9. Schmid, F. and Junker, F.: Die Brachymesophalangie des Kleinfingers. Ztschr. Kinderh., 68:399-407, 1950.

   (小指の短中節骨症)

10. Nissen, K. I.: A study in inherited brachydactyly. Ann. Eugenics 5:281-301, 1933.

    (遺伝した短指症の研究)

11. Sachs, M. D.: Familial brachyphalangy. Radiology 35:622-626, 1940.

    (家系性短節骨症)

12. Walter, M. R.: Five generations of short digits. J. Hered. 29:143-144, 1938.

    (短指の5世代)

13. Bouet, O.: Symmetrische Brachydactylie und Hypophalangie in Hand und Fuss. Acta Radio. 15:24-27, 1934.

    (手足の対称的短指症及び短節骨症)

14. Rochlin, D. G. and Schirmunsky, K: Arthropathia psoriatica; (Rontgenographische Untersuchung). Fortschr. Geb. Rontgenstrahlen. 33:955-961, 1925.

（乾癬性関節症）

15. Werner, A. A., et at.: Growth in children with mongolism; A 4 year study of 8 patients. Am. J. Dis. Child. 57:554-563, 1939.

（モンゴリズム症を有する小児の発育；８患者に対する４ケ年間の研究）

16. Benda, C. E.: Studies in mongolism; growth and physical development. Arch. Neurol. & Psychiat. 41:83-97, 1939.

（モンゴリズム症の研究；発育及び成長）

17. Cohn, B.N.E. and Ravin, A.: An unusual case of brachydactyly. J. Hered. 32:45-48, 1941.

（短指症の稀な症例）

18. Thomsen, O.: Hereditary growth anomaly of thumb. Hereditas, 10:261-273, 1927-28.

（拇指の遺伝的発育異常）

19. Plummer, G. W.: Anomalies occurring in children exposed in utero to atomic bomb in Hiroshima. Pediatrics 10:687-692, 1952.

（広島における胎内被爆児に発現せる異常）

20. Greulich, W. W. and Pyle, S. I.: Radiographic Atlas of Skeletal Development of the Hand and Wrist. Stanford, Stanford Univ. Press, 1950.

（手及び手首の骨骼発育のX線像の図譜）

21. Sutow, W. W.: Skeletal maturation in healthy Japanese children, 6 to 19 years of age; comparison with skeletal maturation in American children. Hiroshima J. Med. Sci. 2:181-191, 1953.

（６才より19才までの健康日本人小児における骨骼の成熟；米国小児における骨骼成熟との比較）