

BENIGN TUMORS OF THE DIGESTIVE TRACT AMONG A-BOMB
SURVIVORS, HIROSHIMA, 1961-70

原爆被爆者における消化管の良性腫瘍，広島，1961—70年

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ATOMIC BOMB CASUALTY COMMISSION

国立予防衛生研究所—原爆傷害調査委員会

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報告書

報告書

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SUMMARY

The occurrence of benign tumors and diverticula of the digestive system in the JNII-ABCC Life Span Study autopsy series was investigated. There were 664 benign tumors and 40 diverticula. Polyps were the most frequent tumor, were found more often in older people, occurred as single pedunculated well-differentiated adenomatous tumors, and most were less than 5mm in greatest dimension. Larger polyps tended to have more atypism, but none showed definite premalignant change. No transitions from benign to malignant polyps were seen. Polyps were found most frequently in the large intestine and in a large number (21%), when cancer of the large intestine was present, benign polyps were also found. Far more polyps are found when special intensive search is made for them. Comparison of the occurrence of benign polyps in different geographic areas must be adjusted for age and method of search as well as for other features such as histologic type, dysplasia, etc. There was no evidence that the occurrence of benign tumors or diverticula was related to prior ionizing radiation exposure at the time of the atomic bomb.

INTRODUCTION

It has been demonstrated in experimental animals that ionizing radiation is carcinogenic with effects

要 約

ABCC - 予研寿命調査集団の剖検調査における消化器系の良性腫瘍および憩室の発生頻度を調べた。良性腫瘍は664例であり、憩室は40例あった。腫瘍の中で最も多かったのはポリープで、老齡群により多く認められ、十分に分化した単一の有茎性腺腫様腫瘍として発生し、そのほとんどは最大直径5mm未満であった。大型のポリープはより著しい異型性を示す傾向があったが、明確な前癌性変化を示すものはなかった。良性から悪性のポリープへの移行も認められなかった。ポリープは大腸に最も多く、大腸癌例の多く(21%)には良性ポリープの併発も認められた。特別の集中的な調査を行えば、はるかに多くのポリープが発見される。従って、各地域における良性ポリープの発生頻度の比較を行う場合に、組織型、異形成などについてのみならず、年齢や調査方法についても補正が必要である。良性腫瘍または憩室の発生と既往における原爆電離放射線被曝との関係は認められなかった。

緒 言

電離放射線に発癌性があり、多くの腫瘍および器官に影

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in numerous tumors and organs.¹ In the study of the A-bomb survivors in Hiroshima and Nagasaki it has been shown that the irradiated survivors had an increased risk for developing leukemia, cancers of the thyroid, breast and lung, and salivary gland tumors.²⁻⁹ Although the mucosa of the gastrointestinal tract is highly radiosensitive and reacts rapidly in the early postirradiation stage, it appears that healing, if it occurs, is complete and without apparent subsequent delayed reactions. Studies of the survivors so far have shown no radiation-related increased risk for gastric cancer or for cancer of the large intestine.¹⁰⁻¹²

The investigation of the relation between gastrointestinal tumors and radiation was extended to determine the prevalence at autopsy of various benign lesions in the gastrointestinal tract, to examine their relation to coexistent gastrointestinal cancer and to test the possibility of a relation between radiation at the time of the bomb (ATB) and the presence of these benign lesions.

MATERIAL AND METHODS

The study population has been described in detail.¹³⁻¹⁵ Briefly, it consisted of a selected and fixed sample of persons who were exposed to various levels of ionizing radiation ATB and included controls who received no radiation. Members of the sample were interrogated and from the data obtained an estimated radiation exposure dose in rad was calculated with due allowance for shielding factors.^{16,17} A radiation dose could not be estimated for approximately 3% of the survivors and they are listed in the tables as dose unknown. As is the usual practice, all data and interpretations were recorded without knowledge of radiation dose.

During the 10-year period, 1961-70, 2975 autopsies were performed for an autopsy rate approximately 37% of sample members who have died. The presence of benign tumors and diverticula of the entire gastrointestinal tract were recorded. The method of observation and recording was different in two 5-year periods. In 1961-64 and in 1968 the data were collected from the routine autopsy protocols and histologic sections as prepared by a large number of pathologists. In the 5-year period, 1965-67 and 1969-70, one of the authors personally examined the entire gastrointestinal tract of all autopsies at ABCC Hiroshima noting the presence of all lesions and sampling them for histologic examination. The hematoxyline and eosin stain was used in all cases and when indicated, special stains were employed including Weigert and van Gieson stains.

The location of all benign tumors was identified by topographic site as listed in the International

響があることは動物実験によって証明されている。¹ 広島および長崎における原爆被爆者調査において、被爆者に白血病、^{2,3} 甲状腺癌、^{4,5} 乳癌、⁶ 肺癌^{7,8} および唾液腺腫瘍⁹ 発生の危険度が増加していることが明らかにされている。胃腸管粘膜は放射線感受性が高く、被曝後の早期の段階において急速に反応を示すが、ひとたび治癒機転が起きれば完治するものであって、その後に遅発性反応と思えるものは起こらないようである。これまでの被爆者調査では、放射線に関係ある胃癌^{10,11} または大腸癌¹² の危険度の増加は認められていない。

胃腸腫瘍と放射線との関係を調べるための調査の範囲を広げて、胃腸管における各種良性病変の剖検時頻度を確かめ、胃腸癌との共存関係を調査し、原爆放射線とこれら良性病変発生との間に関係の存在する可能性について検討した。

材料および方法

調査集団については別に詳しく述べてある。¹³⁻¹⁵ 簡単に説明すれば、この集団は原爆時に異なる量の電離放射線に被曝した者から選択され、それに放射線を受けなかった対照者を加えた固定集団で構成されている。この調査の対象者について質問調査を行い、それによって得た資料から遮蔽因子^{16,17} を考慮して被曝線量推定値 (rad) を求めた。被爆者の約3%については被曝線量の推定値を求めることはできない。これらは線量不明として表に示した。従来の調査法に従って病理医は資料の記載および解釈に当たり、被曝線量を知らされないで行った。

1961-70年の10年間に、2975例の剖検を行ったが、これは死亡した対象者の約37%に相当する剖検率である。胃腸管全体の良性腫瘍および憩室を対象に記録した。5年ずつの二つの期間において採用された観察および記録方法は異なっていた。すなわち、1961-64年および1968年には多数の病理専門医が作った通常剖検記録および組織切片から資料を集めた。一方、1965-67年および1969-70年の5か年間においては、著者らのうち、病理専門医である2人のどちらかが広島ABCCにおいて実施されたすべての剖検例の胃腸管全体を調べ、すべての病変の発見に努め、病巣から標本を作って組織学的検査を行った。すべての検体についてヘマトキシリン・エオジン染色を行い、必要ある場合には Weigert 染色および Van Gieson 染色を含む特別の染色も行った。

すべての良性腫瘍の部位は、国際疾病分類提要¹⁸ の記載

Classification of Diseases manual.¹⁸ Lesions of the large intestine were recorded as being in the appendix, cecum, ascending colon, transverse colon, descending colon or in the sigmoid colon-rectum, the last being considered a single area. In 32 autopsies the location of the benign lesions in the large intestine was not described and these were listed as 'intestine (NOS).'

Polyps were described as sessile or pedunculated. They were classified histologically according to the criteria of Morson^{19,20} and Arthur²¹ as metaplastic or adenomatous. Metaplastic polyps contained dilated mucosal glands varying considerably in height and resembling endometrium in secretory phase and generally appearing pale and eosinophilic. Adenomatous polyps were truly neoplastic with increased cellularity and chromicity. The adenomatous polyps were divided according to the degree of cellular atypism. In grade 1, there was nuclear enlargement and hyperchromatism without change in polarity. In grade 2, there was loss of basal polarity. In grade 3 there was nuclear pleomorphism. grade 4 would include polyps with carcinoma-in-situ and borderline invasive carcinoma but no grade 4 polyps were found in this autopsy series.

Only the submucosal and intramural leiomyomas, hamartomas, lipomas, angiomas, cysts, neurilemmoma, and fibromas were considered in this study. No serosal tumors were included. The two carcinoids found were intramural. There were 35 autopsies with diverticula and these were included because questions had been raised related to the prevalence of diverticula in Japanese.

RESULTS

As seen in Table 1, 664 benign tumors were found in 638 of the 2975 autopsies. In addition, 40 diverticula were found in 35 autopsies. Most of the benign tumors were polyps (64%) followed by leiomyomas (18%), hamartomas (7%), and lipomas (6%). Only two carcinoids (0.3%) were found.

There were few buccal and esophageal lesions and those found were mainly leiomyomas of the esophagus. In the small intestine (Table 2) solid intramural tumors predominated, with hamartomas consisting mainly of pancreatic rests being most frequent. Only 15 polyps were found in the small intestine (0.5% of the autopsies).

Polyps of the stomach and large intestine including sigmoid colon and rectum were the most frequent tumors found. They were present in 12.8% of all autopsies and 59.9% of all benign gastrointestinal tumors recorded were polyps of the stomach and large

intestine. For example, large intestine lesions were recorded as being in the appendix, cecum, ascending colon, transverse colon, descending colon or in the sigmoid colon-rectum, the last being considered a single area. In 32 autopsies the location of the benign lesions in the large intestine was not described and these were listed as 'intestine (NOS).'

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結果

表1に示すように、2975剖検例中638例に664件の良性腫瘍を認めた。その他35剖検例に40件の憩室を認めた。良性腫瘍の大部分はポリープ(64%)で、次いで平滑筋腫(18%)、過誤腫(7%)、および脂肪腫(6%)の順であった。類癌腫は2件(0.3%)のみ認められた。

類内面および食道病変はほとんどなく、発見されたものは主として食道の平滑筋腫であった。小腸では(表2)充実性壁内腫瘍が大多数を占め、主として脾臓残遺より成る過誤腫の頻度が最も高かった。小腸にはポリープが15件しか認められなかった(剖検例の0.5%)。

胃およびS状結腸、直腸を含む大腸では、ポリープの頻度が最も大で、全剖検例の12.8%に認められた。記録された良性胃腸腫瘍の59.9%は胃および大腸のポリープで

TABLE 1 PREVALENCE OF BENIGN TUMORS AND DIVERTICULA IN THE DIGESTIVE CANAL IN 2975 AUTOPSIES, HIROSHIMA, 1961-70

表1 2975剖検例中の消化管における良性腫瘍および憩室の頻度, 広島, 1961-70年

Site	Polyp	Leiomyoma	Hamartoma	Lipoma	Angioma	Cyst	Carcinoid	Neurilemmoma	Fibroma	Tumors	Autopsies	Rate	Diverticulum
Mouth, pharynx, esophagus	1	15	0	1	2	3	0	0	0	22 3.3%	22	0.7	2
Stomach	89	91	6	3	2	1	1	2	0	195 29.4%	182	6.6	0
Small intestine	15	13	42	22	13	0	0	0	1	106 16.0%	100	3.6	12
Large intestine	207	1	0	15	0	0	0	0	0	223 33.6%	218	7.6	15
Sigmoid-rectum	86	0	0	1	1	0	1	0	0	89 13.4%	87	3.0	8
Intestine not specified	27	0	0	0	1	1	0	0	0	29 4.4%	29	1.0	3
Total	425 64.0%	120 18.1%	48 7.2%	42 6.3%	19 2.9%	5 0.8%	2 0.3%	2 0.3%	1 0.2%	664 100.0%	638	21.4	40

Multiple lesions of the same type and in the same site were counted only once but each kind of lesion was counted separately (e.g., polyp and leiomyoma of the stomach were counted separately).

Rate: (Number of tumors/2975 autopsies) × 100

TABLE 2 PREVALENCE OF BENIGN TUMORS AND DIVERTICULA, SMALL INTESTINE

表2 小腸における良性腫瘍および憩室の頻度

	Hamartoma	Lipoma	Polyp	Leiomyoma	Angioma	Fibroma	Total	Autopsies	Diverticulum
Duodenum	18	5	5	2	1	0	31 29.2%	29	7
Jejunum	22	10	2	6	11	0	51 48.1%	50	0
Ileum	2	7	8	5	1	1	24 22.6%	21	5
Total	42 39.6%	22 20.8%	15 14.2%	13 12.3%	13 12.3%	1 0.9%	106 100.0%	100	12

TABLE 3 PREVALENCE OF BENIGN TUMORS AND DIVERTICULA, LARGE INTESTINE

表3 大腸における良性腫瘍および憩室の頻度

Site	Polyp	Lipoma	Leiomyoma	Total	Autopsies	Diverticulum
Cecum	36	9	1	46 20.6%	43	6
Ascending colon	60	4	0	64 28.7%	62	4
Transverse colon	64	1	0	65 29.1%	65	0
Descending colon	47	1	0	48 21.5%	48	3
Total	207 92.8%	15 6.7%	1 0.4%	223 100.0%	218	13

Two diverticula but no tumors were found in the appendix.

intestine (Table 1). The distribution of the polyps of the large intestine is given in Table 3. There was no significant difference in prevalence of polyps in the different segments of the large intestine.

Only 40 diverticula in 35 autopsies were found in the gastrointestinal tract. These appeared to differ in the small and large intestine. In the former, the diverticula seemed to be related to congenital weakness of the small intestine wall whereas in the latter the diverticula appeared to be related to inflammatory processes.

As expected, benign tumors were found far more frequently when a directed search was made for them than when a casual routine autopsy examination was made (Table 4). With routine methods, the prevalence of these lesions varied from 1.2% to 5.0% in different locations while with the more exact method of examination the prevalence varied from 5.5% to 13.8% (Table 4). In each location the difference was highly significant ($P < 0.001$). Most of this difference was due to the increased recognition of polyps most of which were quite small. The difference in rates was 6.9% for polyps found at routine autopsy and 22.2% for more exact examination (Table 5). The 320 polyps found by the latter method were observed in 1445 autopsies.

あった(表1)。大腸ポリープの分布は表3に示す。大腸の各部分におけるポリープの頻度には有意差はなかった。

胃腸管に憩室を認めたのはわずかに35剖検例で数にして40個に過ぎなかった。小腸と大腸とに存在するもの間に差異があるようである。前者では憩室は小腸壁の先天的脆弱に関係しているようであるが、一方、後者では炎症過程と関係があるようであった。

予期されるように、良性腫瘍の発見率は、注意深く探究を行った場合の方が、通常の剖検で発見する場合よりもはるかに高かった(表4)。通常の剖検ではこれら病変の頻度は部位によって1.2%から5.0%であったが、精密な検査方法では5.5%から13.8%であった(表4)。従って各部位において極めて高い有意差が認められた($P < 0.001$)。この差は、ポリープ特に極めて小さなものの探知率の増加によるものであった。通常剖検で認めたポリープの探知率は6.9%であったのに対して、精密な検査によるものは22.2%であり、差があった(表5)。1445剖検例中、後者の方法によって320個のポリープが発見された。

TABLE 4 PREVALENCE OF BENIGN TUMORS AND DIVERTICULA, MAJOR DIGESTIVE LOCATIONS AND PERIODS

表4 良性腫瘍および憩室の頻度：主な消化器系内の部位および期間

Site	1961-70		1961-64,68		1965-67,69,70		χ^2 test
	Autopsies 2975		1530		1445		
	No.	Rate	No.	Rate	No.	Rate	
Stomach	195	6.6	76	5.0	119	8.2	***
Small intestine	118	4.0	19	1.2	99	6.9	***
Large intestine	238	8.0	39	2.6	199	13.8	***
Sigmoid & rectum	97	3.3	18	1.2	79	5.5	***

*** $P < 0.001$

Rate-% of total autopsies

Benign tumors of all types increased in prevalence with age being most frequent in persons 70 years old or older (Table 6). This was true for benign tumors in all locations. It was also true when the gastrointestinal tract was examined routinely and when examined intensively and in detail. No significant difference in prevalence by sex was seen in any location (Table 7).

Table 8 shows the distribution of polyps in the segments of the large intestine by number in each autopsy. Most were single polyps (80%).

各種良性腫瘍の頻度は年齢と共に増加し、70歳以上の者において最高であった(表6)。これは各部位における良性腫瘍について認められた所見であり、また胃腸管の通常検査の場合および厳格で詳細な検査を行った場合でも認められた傾向である。いずれの部位においても、性別頻度に有意差は認められなかった(表7)。

表8は、各剖検例における大腸各部の発生数別ポリープの分布を示す。大部分は単一性ポリープであった(80%)。

TABLE 5 PREVALENCE OF BENIGN TUMOR AND DIVERTICULA, DIGESTIVE CANAL, BY PERIOD OF STUDY

表5 消化管における調査期間別良性腫瘍および憩室の頻度

Site	1961-70		1961-64,68		1965-67,69,70		χ ² test
	Autopsies 2975		1530		1445		
	No.	Rate	No.	Rate	No.	Rate	
Polyp	425	14.3	105	6.9	320	22.0	***
Leiomyoma	120	4.0	42	2.8	78	5.4	**
Fibroma	1	0.0	1	0.1	0	0.0	.
Lipoma	42	1.4	3	0.2	39	2.7	***
Hamartoma	48	1.6	7	0.5	41	2.8	***
Angioma	19	0.6	3	0.2	16	1.1	**
Carcinoid	2	0.1	0	0.0	2	0.1	.
Neurilemmoma	2	0.1	0	0.0	2	0.1	.
Cyst	5	0.2	2	0.1	3	0.2	NS
Diverticulum	40	1.3	10	0.7	30	2.1	***

*** P<0.001

** .001<P<.01

NS-Not significant

-Number too small for test

Rate-% of autopsies

There were no cases of familial polyposis in this autopsy series. Only 10% of the polyps were sessile and 90% were pedunculated (Table 9).

A total of 401 polyps of the large intestine were found in 320 of the autopsies. Of these, 104 were metaplastic polyps and 297 were adenomatous polyps (Table 10). Although none of the adenomatous polyps showed a severe degree of atypism, there was a tendency for the polyps in the descending colon and sigmoid-rectum segment to be of a somewhat higher grade of atypism.

Most of the polyps were small with 90% being less than 5mm in greatest dimension (Table 11). Only five polyps were 10mm or larger in diameter and these were located in the descending colon, sigmoid, and rectum. There was a greater degree of cellular atypia in the larger polyps (Table 12).

Table 13 shows the distribution of all of the benign gastrointestinal tumors and diverticula in relation to the occurrence of malignant tumors of the digestive system in the 2975 autopsies. With the exception of the large intestine there is no indication of a direct association of these lesions. Of 678 benign lesions, 114 (16.8%) were found in persons who had cancer somewhere in the gastrointestinal tract. Table 14 gives the relation between benign polyps and carcinoma of the stomach and large intestine excluding the recto-sigmoid portion which could not be evaluated accurately for the presence of benign polyps when extensive carcinomas were present. In both sites less

本調査の剖検例には家族性ポリープ症例は1例もなく、ポリープの10%は無茎性であり、90%は有茎性であった(表9)。

剖検例中320例に大腸ポリープが合計401個認められた。このうち104個は異形成性ポリープで297個は腺腫性ポリープであった(表10)。腺腫性ポリープはいずれも高度の異型性を示さなかったが、下行結腸およびS状結腸一直腸部のポリープはやや高度の異型性を示す傾向があった。

ポリープの大部分は小さく、90%は最大径5mm以下であった(表11)。径10mm以上のポリープは5個だけあったが、これらは下行結腸、S状結腸および直腸にあった。大きなポリープほど、より高度の細胞異型性を認めた(表12)。

表13は、2975剖検例における全良性胃腸腫瘍および憩室の分布と消化系の悪性腫瘍の発生との関係を示す。大腸を除いては、これら病変に直接的関係は認められない。良性病変678個中、114個(16.8%)は胃腸管のどこかに癌を有する者に認められた。表14は胃および大腸の良性ポリープと癌との関係を示す。ただし、直腸-S状結腸部では広範囲の癌がある場合には、良性ポリープの発生を正確には評価できないため除外した。両部位において

TABLE 6 BENIGN TUMORS AND DIVERTICULA, DIGESTIVE CANAL: AGE DISTRIBUTION

表6 消化管における良性腫瘍および憩室の年齢分布

Site	Age	Polyp	Leiomyoma	Hamartoma	Lipoma	Angioma	Cyst	Carcinoid	Neurilemmoma	Fibroma	Total	Autopsies	Rate	Polyps only	Diverticulum
Mouth, pharynx, esophagus	<59		1								1	538	0.19	-	
	60-69		11				1				12	786	1.53	-	1
	70+	1	3		1	2	2				9	1651	0.55		1
Stomach	<59	1	1	1							3	538	0.56	.1	
	60-69	16	21								37	786	4.71	2.0	
	70+	72	69	5	3	2	1	1	2		155	1651	9.39	4.4	
Small intestine	<59	1	1	3							5	538	0.93	.2	
	60-69	2	2	13	5	2					24	786	3.05	.3	
	70+	12	10	26	17	11				1	77	1651	4.66	.7	12
Large intestine	<59	16			1						17	538	3.16	3.0	2
	60-69	38	1		3						42	786	5.34	4.8	5
	70+	153			11						164	1651	9.93	9.3	8
Sigmoid-rectum	<59	9									9	538	1.67	1.7	
	60-69	19						1			20	786	2.54	2.4	1
	70+	58			1	1					60	1651	3.63	3.5	7
Intestine not specified	<59	1									1	538	0.19	.2	
	60-69	7					1				8	786	1.02	.9	2
	70+	19				1					20	1651	1.21	1.2	1
Total		425	120	48	42	19	5	2	2	1	664	2975		14.3	40

Rate-% of autopsies.

TABLE 7 BENIGN TUMORS AND DIVERTICULA, DIGESTIVE CANAL: SEX DIFFERENCE

表7 消化管における良性腫瘍および憩室の性別差

Site	Sex	Polyp	Leiomyoma	Hamartoma	Lipoma	Angioma	Other	Total	Autopsies	Rate	Diverticulum
Mouth, pharynx, esophagus	M	1	7		1	2	2	13	1480	0.9	1
	F		8				1	9	1495	0.6	1
Stomach	M	40	42	3	1	1	1	88	1480	6.0	
	F	49	49	3	2	1	3	107	1495	7.2	
Small intestine	M	7	8	14	7	9	1	46	1480	3.1	4
	F	8	5	28	15	4		60	1495	4.0	8
Large intestine	M	113			4			117	1480	7.9	10
	F	94			11			106	1495	7.1	5
Sigmoid-rectum	M	47				1		48	1480	3.2	1
	F	39			1		1	41	1495	2.7	7
Intestine not specified	M	18						18	1480	1.2	2
	F	9				1	1	11	1495	0.7	1

"Other" includes 5 cysts, 2 neurilemmomas, 2 carcinoids, and 1 fibroma.

Rate-% of autopsies.

TABLE 8 NUMBER OF AUTOPSIES WITH ONE, TWO, THREE, FOUR, OR FIVE POLYPS BY SEGMENT OF LARGE INTESTINE

表8 ポリープ1個, 2個, 3個, 4個または5個を有する剖検例数の大腸各部位別件数

Segment	Total Autopsies	Number of Polyps											
		1		2		3		4		5			
		No.	%	No.	%	No.	%	No.	%	No.	%		
Cecum	36	29	80.6	7	19.4								
Ascending	60	46	76.7	11	18.3	2	3.3					1	1.7
Transverse	64	49	76.6	11	17.2	4	6.2						
Descending	47	38	80.9	7	14.9	1	2.1	1	2.1				
Sigmoid-rectum	86	74	86.0	11	12.8	1	1.2						
Large intestine not specified	27	19	70.4	6	22.2	1	3.7	1	3.7				
Total	320*	255	79.7	53	16.7	9	2.8	2	0.6	1	0.3		

* Autopsies with polyps. Total polyps - 401

TABLE 9 SESSILE AND PEDUNCULATED POLYPS OF THE LARGE INTESTINE

表9 大腸の無茎性および有茎性ポリープ

Segment	Autopsies with polyp	Polyps	Sessile		Pedunculated	
			No.	%	No.	%
Cecum	36	43	6	14.0	37	86.0
Ascending	60	79	4	5.1	75	94.9
Transverse	64	83	13	15.7	70	84.3
Descending	47	59	4	6.8	55	93.2
Sigmoid-rectum	86	99	10	10.1	89	90.0
Large intestine not specified	27	38	2	5.3	36	94.7
Total	320	401	39	9.7	362	90.3

TABLE 10 METAPLASTIC AND ADENOMATOUS POLYPS OF THE LARGE INTESTINE

表10 大腸の異形成性および腺腫性ポリープ

Segment	Metaplastic Polyps	Adenomatous Polyps	Adenomatous Polyps by Grade					
			1		2		3	
			No.	%	No.	%	No.	%
Cecum	12	31	26	83.9	4	12.9	1	3.2
Ascending	17	62	42	67.7	17	27.4	3	4.8
Transverse	21	62	50	80.6	9	14.5	3	4.8
Descending	14	45	28	62.2	12	26.7	5	11.1
Sigmoid-rectum	30	69	44	63.8	19	27.5	6	8.7
Large Intestine not specified	10	28	21	75.0	6	21.4	1	3.6
Total	104	297	211	52.6	67	16.7	19	4.7
	25.9%	74.1%						

TABLE 11 POLYPS OF THE LARGE INTESTINE BY GREATEST DIMENSION

表11 大腸の最大径別ポリープ

Segment	0-4 mm		5-9 mm		10+ mm	
	No.	%	No.	%	No.	%
Cecum	41	95.3	2	4.6	0	
Ascending	73	92.4	6	7.6	0	
Transverse	79	95.2	4	4.8	0	
Descending	47	79.7	9	15.3	3	5.1
Sigmoid-rectum	86	86.9	11	11.1	2	2.0
Large Intestine not specified	34	89.5	4	10.5	0	
Total	360	89.8	36	9.0	5	1.2

TABLE 12 RELATION OF TYPE AND ATYPISM TO SIZE IN 401 POLYPS OF THE LARGE INTESTINE

表12 大腸ポリープ 401例における型および異型性と大きさとの関係

Type and Grade	Total	0-4 mm		5-9 mm		10+ mm	
		No.	%	No.	%	No.	%
Metaplastic	104	94	90.4	9	8.7	1	1.0
Adenomatous 1	211	200	94.8	10	4.7	1	0.5
Adenomatous 2	67	55	82.1	11	16.4	1	1.5
Adenomatous 3	19	11	57.9	6	31.6	2	10.5
Total	401	360	89.9	36	9.0	5	1.2

1,2,3-Grade of Atypism

TABLE 13 COEXISTENCE OF BENIGN TUMORS OR DIVERTICULA AND MALIGNANT TUMORS IN THE GASTROINTESTINAL TRACT

表13 胃腸管における良性腫瘍または憩室と悪性腫瘍との併存

Cancer (1)	Number Coexistent (3)						Total
	Mouth, esophagus	Stomach	Small intestine	Large intestine	Sigmoid-rectum	Intestine not specified	
(2) Autopsies with benign tumors & diverticula	24	182	112	233	95	32	678
Mouth & esophagus	46	1	6	0	1	0	9
%	1.5	4.1	3.3	0.4	1.1		1.3
Stomach	390	3	13	14	31	2	74
%	13.1	12.5	7.1	12.3	13.1	11.6	10.9
Small intestine	5	0	1	0	0	0	1
%	0.2		0.5				0.1
Large intestine	88	2	7	16	3		30
S-colon rectum	3.0	8.3	1.0	6.1	6.8	3.2	4.4
Total	529	6	22	21	48	15	114
%	17.8	25.0	12.0	18.8	20.6	15.8	16.8

(1) Total cancers and % in each site in 2975 autopsies

(2) Total benign tumors and diverticula in each site

(3) Sites with cancer and a benign tumor or diverticula in the same patient by number and % of total benign tumors in that site

TABLE 14 COEXISTENCE IN THE SAME PERSON OF BENIGN POLYPS AND CARCINOMA IN THE STOMACH AND LARGE INTESTINE IN 2975 AUTOPSIES

表14 2975剖検例中同一人の胃および大腸における良性ポリープと癌との併存

Site	Cancers	Polyps	Polyps & Cancer	Polyps Only	χ^2 test
	A	B	C		
Stomach	390	89	7	82	
Rate 1	13.1	3.0	0.2	2.8	2.2 (P>.10)
Rate 2			1.8/7.9		
Large Intestine	56	207	12	195	
Rate 1	1.9	7.0	0.4	6.6	18.4 (P<.01)
Rate 2			21.4/5.8		

Rate 1 = % of total (2975) autopsies

Rate 2 = % of polyps in persons with cancer (C/A)% of cancers in persons with polyps (C/B)

χ^2 = Test of the difference in the proportion of cancers with polyps and cancers without polyps

TABLE 15 PREVALENCE RATE OF BENIGN TUMORS BY RADIATION DOSE AND SITE OF TUMOR, LIFE SPAN STUDY SAMPLE HIROSHIMA 1969-70

表15 良性腫瘍の頻度：放射線量および腫瘍部位別，寿命調査対象集団，広島，1969-70年

Benign Tumor	NIC	T65 Dose (Rad)				Total	χ^2 test
		0-9	10-99	100+	Unk.		
Autopsies	651	1523	601	168	32	2975	
Mouth & esophagus	Obs. 4	16	2	1	1	24	NS
	Rate 0.6	1.1	0.3	0.6	3.1		
Stomach	Obs. 37	99	35	8	3	182	NS
	Rate 5.7	6.5	5.8	4.8	9.4		
Small intestine	Obs. 23	55	20	12	2	112	NS
	Rate 3.5	3.6	3.3	7.1	6.3		
Large intestine	Obs. 50	129	41	10	3	233	NS
	Rate 7.7	8.5	6.8	6.0	9.4		
Sigmoid-rectum	Obs. 19	48	18	9	1	95	NS
	Rate 2.9	3.2	3.0	5.4	3.1		
Total	Obs. 133	347	116	40	10	646	
	Rate 20.4	22.8	19.3	23.8	31.3	21.7	

Rate = % of autopsies in that radiation dose group.

32 autopsies site not determined (Intestine NOS) not included.

NIC = Persons not in city ATB.

TABLE 16 PREVALENCE OF POLYPS OF STOMACH AND LARGE INTESTINE BY RADIATION DOSE, LIFE SPAN STUDY SAMPLE HIROSHIMA 1961-70

表16 胃および大腸ポリープの頻度：放射線量別，寿命調査対象集団，広島，1961-70年

Polyp	NIC	T65 Dose (Rad)				Total	χ^2 test
		0-9	10-99	100+	Unk.		
Autopsies	651	1523	601	168	32		
Stomach	Obs. 16	47	18	6	2	89	NS
	Rate 2.5	3.1	3.0	3.6	6.3	3.0	
Large intestine	Obs. 64	157	52	18	2	293	NS
	Rate 9.8	10.3	8.7	10.7	6.3	9.8	

Rate = % of autopsies in that radiation dose group.

NIC = Persons not in city ATB.

than 10% of the polyps were associated with a concomitant cancer (stomach 8%, large intestine 6%) but there was a statistically significant association of polyps and cancer in the large intestine. Whereas gastric polyps were found in only 2% of stomachs containing cancer, polyps of the large intestine were found in 21% of large intestines containing cancer. However, no instance of a transition stage between a benign polyp and infiltrating carcinoma was found.

Table 15 gives the distribution by ionizing radiation exposure dose for the benign tumors and diverticula. There is no evidence of an association between these factors. Only the polyps of the stomach and large intestine were considered in Table 16. Again there is no evidence of a relation between the presence of these polyps and radiation exposure ATB.

DISCUSSION

ABCC studies of cancer of the gastrointestinal tract have shown no evidence of a delayed carcinogenic effect resulting from radiation exposure of the A-bomb survivors.^{10,11} This report shows that there was no evidence of a radiation effect in the subsequent development of benign tumors including polyps. It is not at all clear why this should be so. Gastrointestinal mucosa is quite sensitive to ionizing radiation and gastric carcinoma is the most frequent form of cancer in Japanese. Search for analogies leads to paradoxes. Bone marrow also sensitive to ionizing radiation showed a marked increase in leukemia in the survivors. Lung, relatively insensitive to ionizing radiation but the site of the second most frequent cancer in Japanese, also exhibited a delayed radiation carcinogenic effect.^{7,8} If polyps of the gastrointestinal tract are premalignant tumors, they, like the cancers show no evidence that they are more frequent in the irradiated survivors.

A not surprising finding was that the prevalence rate for polyps was significantly related to the intensity of the search. A prevalence rate of only 7% was found by casual inspection but careful search increased the prevalence rate to 22%. In large measure this difference is related to the size of most of the polyps 90% of which were 4mm or less in largest diameter. These very small polyps were for the most part histologically innocuous while the larger polyps had a greater tendency for dysplastic change.

Despite the more intensive search and the larger yield there was no change in the two groups in prevalence of polyps by age, sex or location. All benign tumors including polyps were significantly more frequent in older people in both the routine and the special search methods. In this autopsy series only 18% of the subjects were below age 60 at the time of

随伴性癌(胃8%, 大腸6%)と関連性の認められたポリープは10%以下であったが、大腸においては、ポリープと癌との間に統計的に有意な関連性が認められた。胃のポリープは胃癌の認められた例のわずか2%に見られたに過ぎないが、大腸ポリープは大腸癌の認められた例の21%に見られた。しかしながら、良性ポリープから侵襲性癌への過渡期にある例は1例も見られなかった。

表15は良性腫瘍および憩室の電離放射線被曝線量別分布を示す。これらの要因の間には関連性は認められない。表16においては、胃および大腸のポリープのみについて考察を加えた。これらポリープの発生と原爆放射線被曝との間にも関連性は認められなかった。

考 察

胃腸管の癌に関するABCCの調査では、原爆被爆者の放射線照射による遅発性発癌影響の兆候は認められない。^{10,11} 本報告書は、放射線被曝がポリープを含む良性腫瘍の発生に影響のないことを示している。その理由は全く分からない。胃腸粘膜は電離放射線に対して非常に敏感であり、しかも胃癌は日本人における最も頻度の高い癌である。これに類似した状態を呈するものについて調べたが、逆の結果が得られている。すなわち、骨髄も電離放射線に対して敏感であるが、原爆被爆者には白血病が著しく増加した。肺は電離放射線に対して比較的鈍感であるが、日本人においては癌の発生部位としては2番目に高い頻度を示しており、その肺に遅発性の放射線発癌影響が認められた。^{7,8} 胃腸管のポリープが前癌性腫瘍であるとしても、これらポリープは癌と同じように、被爆生存者においてとくに頻度が高いという証拠はない。

ポリープの有病率が、探索の程度に対して有意な関係を示したということは驚くに値しない。通常剖検では、発見率はわずかに7%に過ぎなかったが、精密な探索を行った際の発見率は22%に増加した。この差は主としてポリープの大きさに関係しており、本調査で発見したポリープの90%は最大径4mm以下であった。これら非常に小さなポリープは大部分組織学的には無害であるが、大きいポリープは異形成性に変化する傾向がより大であった。

より強力な探索およびより高い発見率が得られたにもかかわらず、この二つの群の間において年齢、性または部位別ポリープ頻度に変化はなかった。ポリープを含むあらゆる良性腫瘍の頻度は、通常調査法または精密探索法のいずれを用いた場合でも高齢者ほど有意に高かった。本調査の剖検例中、死亡時60歳以下の者はわずか18%に

death, 26% were between 60 and 69, and 56% were 70 years old or older. The intensive search procedure revealed a 22% rate for polyps but this high rate was a reflection of the age distribution of the autopsy sample. The prevalence rate for polyps of the stomach and large intestine in those 70 years old or older was 3.7 times that for those under 60 years of age. Age correction data should be given in comparing prevalence rates for gastrointestinal polyps in different geographic areas.

Gastrointestinal polyps were found frequently but there was no evidence in this study of a transition from benign polyp to invasive carcinoma as reported by some investigators but denied by others.²²⁻²⁸ Polyps were found in the large intestine with significant increase in frequency if carcinoma was present. Coexistence carcinoma was found in 5.8% of 207 benign intestinal polyps and 1.9% was found in the 2975 autopsies. Despite this association, cancer of the large intestine is infrequent in Japanese, perhaps a further indication that these polyps were not precancerous lesions.

過ぎず、60から69歳の者は26%そして70歳以上は56%であった。強力な探索法によるポリープの発見率は22%であったが、この高い発見率は剖検集団の年齢分布を反映したものであった。70歳以上の者の胃および大腸のポリープ発生率は60歳以下の者の3.7倍であった。地域別に胃腸ポリープ頻度を比較する場合には年齢修正を行うべきである。

胃腸ポリープの頻度は高かったが、本調査では、一部の研究者²²⁻²⁷によって報告され、一方別の研究者^{28,29}によって否定された良性ポリープの侵襲性癌への移行という説を裏付ける証拠は認められなかった。大腸に癌がある場合は、ポリープの頻度は有意に増加していることは認められた。良性腸ポリープ207個の5.8%に癌の併存が認められ、2975剖検例中1.9%に癌が認められた。このような関係があるにもかかわらず、日本人における大腸癌の頻度は低い。このことはポリープが前癌病変ではないことを更に裏付けるものであるかも知れない。

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