TECHNICAL REPORT
31-72
業 績 報 告 書

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ABCC

ATOMIC BOMB CASUALTY COMMISSION

国立予防衛生研究所－原爆傷害調査委員会

JAPANESE NATIONAL INSTITUTE OF HEALTH OF THE MINISTRY OF HEALTH AND WELFARE

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婦人における尿路感染症の長期追跡調査，広島

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SUMMARY

Follow-up of women, proven to have urinary infection during 1962-63, was performed from 15 July through 28 October 1968. The longitudinal study included 75 index subjects and the same number of controls, selected on the basis of age. One-third (25 of the originally infected cases) was found to be infected at the follow-up examination. A variety of clinical and laboratory observations were compared between infected and control subjects. There was no significant difference between index and control cases related to urinary infection except for urinary findings, and no effect of the infection on blood pressure was found.

Significant difference by A-bomb exposure dose was suggested between the index and control as well as between two subgroups of the index. Furthermore, multivariate analysis indicated the exposure dose was the largest contributory factor in the discrimination of infection, the next being weight. Any conclusion regarding an association between urinary tract infection and total body radiation is premature because of the small number of cases, and the possibility of other, undetermined, biases.

要　約

1962－63年の期間に尿路感染症が確認された婦人の追跡調査を，1968年7月15日から10月28日までの間に実施した．本縦断的研究への参加者は，75名の該当対象者および年齢照合のうえ選択された同数の対照婦人である．前回の感染症者中，今回も感染の証明されたものは⅓の25名である．種々の臨床的ならびに検査所見を用い，該当対象群と対照群との間の比較検討を行なったが，検尿所見を除いては，尿路感染に関連した有意差を認めず，感染の血圧に対する影響も認めなかった．

該当対象群と対照群との間に，および該当対象群中の2小群間にともに被曝線量による有意差が示唆された．さらに多変量解析の結果，感染の判別に寄与する最大の因子は被曝線量であり，体重がこれに次ぐことが判明した．尿路感染と全身被曝との関連性については，少数例のため，および他の不明の偏りの可能性のため，結論を下すのは尚早と考えられる．

Keywords: Urinary tract infection, follow-up, discriminant analysis

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INTRODUCTION

Freedman et al[1] reported a number of interesting features in their study of urinary tract infections (UTI) in Hiroshima, 1962-63. These included significantly higher blood pressures in infected women, and suggestively more prevalent urinary tract infections among those proximally exposed to the A-bombs. Freedman et al[2] also evaluated the outcome of antibiotic treatment of UTI in many women who were subjects of the above study, but followed the group only for a short period. The present study is a long-term follow-up on women who had urinary infection during that period and suitable controls.

All subjects are from the ABCC-JNIH Adult Health Study, a large closed population voluntarily undergoing regular biennial examinations as part of the long-term study of delayed effects of the A-bombs of 1945.[3]

The current study investigated the course of UTI, the effect of radiation exposure, and the relation of infection to other medical findings.

METHODS

In the present analysis 99 among 103 women, proven to have UTI in 1962 through 1963, were found in the clinic sample. Results of participation in clinical examination before the present investigation disclosed that nine had died and three had moved out of the contact area. Therefore, the remaining 87 were scheduled for reevaluation over a 3-month period beginning 15 July 1968. However, only 75 actually participated in the current examination (Table 1). During the same period, age-matched (±5 years) controls were randomly selected from female clinic subjects.

Examination and tests were performed according to the same procedure as the original study[1] except for urine culture, which was routinely performed twice. A urine was considered infected when 100,000 becterial colonies/ml were present. Answers to a questionnaire were obtained by a physician (see Appendix).

RESULTS

Twenty-five of the 75 index cases (33.3%) were again found to be infected (Group A); and the other

緒　言

Freedman ら[1]は1962－63年の広島における尿路感染症の研究において，感染婦人の血圧が有意に高い，また近距離原爆被爆者に感染症の有病率が示唆的に高い等若干の興味ある知見を報告している．Freedman，関およびPhair[2]はその対象者中の多数の婦人に抗生物質を投与して，短期間ながら追跡調査を行ない，治療の効果を検討している．本研究は当時感染症の証明された婦人に対して，長年月後の調査を実施し適当な対照を設けて比較検討を行なうものである．

1945年に投下された原爆の後影響の長期研究の一環として一大固定集団に２年ごとの定期検診を行なっているが，対象はすべてこのABCC－予研成人健康調査集団に属している．[3]

本研究では，尿路感染症の経過，放射線被曝の影響および感染の他の医学的所見に対する関係を調査した．

方　法

1962年から1963年に至る期間に尿路感染症の証明された婦人103名中，99名が臨床研究の対象者であった．今回の調査に先だち参加の可能性を調べたところ，９名がすでに死亡し，３名が連絡可能地域外へ転出していることが判明した．したがって，残りの87名を1968年７月15日から３か月の間に調査するはずであったが，実際の参加者総数は75名にすぎなかった（表１）．対照は同期間に受診し，対象者と年齢の照応する（５歳以内の範囲）婦人から無差別に選択した．

診察および検査様式は前回の研究[1]に準じたが，尿培養検査は原則として２回行なうこととし，細菌発育集落が尿１ml当たり100,000こに達するものを感染とした．医師が質問表（別表）に対する回答を求めた．

結　果

まず該当対象者75名中今回も感染のみられた者は，25名（33.3%）であり（以下A群と呼ぶ），他の50名にはこれを

TABLE 1 DISTRIBUTION OF 87 INDEX SUBJECTS (FEMALE) BY AGE AND PARTICIPATION, HIROSHIMA

表1　該当対象者87名の年齢および参加状況別分類，広島婦人

Age 年齢	Total 総数	Examined 診察	Refusal 拒否	Unavailable 来所不能
20-29	1	1	0	0
30-39	14	12	2	0
40-49	16	16	0	0
50-59	14	14	0	0
60-69	33	26	6	1
70 +	9	6	1	2
Total 合計	87	75	9	3

50 had negative urine cultures (Group B). On review of the questionnaires and medical records, nine subjects had not been given initial treatment for urinary infection. Of these, four had persistent infection and five were free of infection. Of those who had treatment of their initially infected urine, 21 were in Group A and 45 in Group B. Fourteen (66.7%) of the former group and 15 (33.3%) of the latter had received additional antibiotic treatment during the interval from 1962-63 and 1970.

The bacteria recovered from Group A subjects were *E. coli* in the great majority (18 of 25), and the other organisms were 3 varieties of paracolon bacilli, 2 of streptococci, 1 aerogenes, and 1 Alcaligenes. In comparison with bacterial species originally detected, there was a change of organism in 11 (44%). *E. coli* in two subjects and paracolon in one instance were apparently cured without treatment. Two untreated cases revealed *E. coli* in each, whereas Proteus and aerogenes were initially found.

Intravenous pyelography was recommended to all Group A subjects, but could be performed in only 10 cases (40%). Minimal pyelonephritis was demonstrated in seven; among those, five subjects had X-ray examination before and the comparison showed no signs of progression during the interval. One subject with pyelonephritis was complicated by the double collecting system. One of the remaining cases revealed a filling defect in the bladder and two others were considered normal.

Among the control women, two were found to have had UTI before the original study. The percentage of affirmative replies regarding UTI in 73 index and equal numbers of controls are shown in Table 2 (excluding the above cases and 2

認めなかった(B群)．質問表および医事記録により治療の有無を調べると，前回未治療の者は9名であり，うち4名はA群，5名はB群に属していた．前回加療の者は，A群21名，B群45名であり，前者の14名(66.7%)，後者の15名(33.3%)は1962－63年以後1970年に至る期間において治療を重ねている．

A群から検出した菌は，大多数(25例中18例)において大腸菌であり，他の3例はパラコロン菌，2例は連鎖球菌ならびに1例ずつがエロゲネス菌とアルカリゲネス菌とであった．前回検出の菌と比較すると，11例(44%)に菌の交代を認めた．なお，全く未治療のままでおそらく治癒したものと思われる2例の菌は大腸菌，1例のそれはパラコロン菌であった．未治療で感染持続の2例ではプロテウス菌とエロゲネス菌をそれぞれ前回証明したが，今回検出した菌はいずれも大腸菌であった．

経静脈腎盂撮影はA群の症例すべてに勧めたが，10例(40%)に施行し得たにとどまった．7例は軽微な腎盂腎炎像を呈したが，うち5例は以前にも本検査を受けており，比較の結果その間なんら悪化の徴候は認められなかった．なお1例は重複尿管を合併していた．残る症例中1例に膀胱の陰影欠損を認めたが，2例は正常と判定された．

対照の婦人中，2例には前回の研究実施以前に尿路感染のあったことが判明した．該当対象者73名およびそれと同数の対照についての尿路感染関連質問に対する肯定的回答率は表2に示すとおりである(前述の2例とそれに対応する該当対象群の2例を除外)．示唆的な差のある排

TABLE 2 PERCENTAGE OF AFFIRMATIVE REPLIES TO QUESTIONNAIRE ITEMS FOR INDEX AND CONTROL

表2　該当対象者および対照群における各質問の肯定的回答率

Item 項目		Index 該当者 Number 数	Index 該当者 %	Control 対照者 Number 数	Control 対照者 %	Significance 有意水準
Urinary infection	尿路感染	32	43.8	9	12.3	P＜.001
Antibiotics	抗生物質治療	40	54.8	17	23.3	P＜.001
Instrumentation	器械挿入	4	5.5	2	2.7	NS
Dysuria	排尿障害	15	20.5	6	8.2	P＜.10
Hesitancy	排尿開始困難	4	5.5	3	4.1	NS
Frequency	頻尿	32	43.8	33	45.2	NS
Hematuria	血尿	1	1.4	2	2.7	NS
Pain	疼痛	27	37.0	19	26.0	NS
Pregnancy	妊娠	2	2.7	3	4.1	NS

TABLE 3 PREVALENCE OF FEMALE URINARY TRACT INFECTION, HIROSHIMA 1962-63

表3　尿路感染症の有病率，広島婦人，1962－63年

Age 年齢	Total 計	Infected 感染症者	%
＜20	475	4	0.8
20-29	193	2	1.0
30-39	775	14	1.8
40-49	555	17	3.1
50-59	602	17	2.8
60-69	443	33	7.4
70＋	148	16	10.8
Total 合計	3191	103	3.2

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corresponding index cases). With the exception of suggestive evidence regarding dysuria, significant differences were noted only in the first two questions. These are: "interval episode of UTI" and "interval treatment with antibiotics". When the reason for antibiotic treatment was checked, this was for urinary infection in 30 of 40 treated cases (75%) among the originally infected cohort (41.1% of the whole group) and 8 of 17 (47.1%) among controls (11% of the whole group).

The prevalence of UTI among women in the Hiroshima study was 3.2%, according to the original report (Table 3). The incidence was calculated for 73 controls. Based on the follow-up interval of 5.8 years from the examination in

尿障害を除いては，有意差の認められたのは，最初の2項目，すなわち，経過期間中の尿路感染罹患および抗生物質による治療如何にすぎなかった．また後者において治療を必要とした疾患を調査したところ，該当感染群においては加療者40名中30名（75%）（全体の41.1%）が尿路感染症のため治療を受けているのに対し，対照群のそれは17名中8名，47.1%（全体の11%）を数えるのみであった．

広島における婦人の尿路感染症有病率は前回の報告によれば3.2%であった（表3）．今回は対照73名について発病率を算出してみた．1962－63年の診察時から1968年10月までの観察期間は5.8年で，年間発病率は表4に示すと

TABLE 4 INCIDENCE OF NEW CASES WITH URINARY TRACT INFECTION BY AGE AT INITIAL EXAMINATION, CONTROL 1962-68

表 4　初回診察時年齢別の新尿路感染症発病率，対照群，1962－68年

Age 年齢	Subjects at Risk 検討対象者数	Person-Years of Observation 観察人年数	New UTI Cases 尿路感染新患	Incidence 発病率 %
20-39	13	76	0	0.0
40-49	16	95	1	1.1
50-59	13	72	1	1.4
60-69	25	141	1	0.7
70 +	6	36	1	2.8
Total 合計	73	420	4	1.0

1962-63 through October 1968, the annual incidence was approximately 1%, as shown in Table 4. It was highest (2.8%) among those of 70 years and more, although the number was small.

Table 5 shows the comparison of means of selected findings by cycle examination year between index and control groups. There was some significance by year in a number of findings, but no statistically significant difference related to UTI was found. There was, especially, no important trend in hematological findings throughout these years. Similar results were noted on comparing Group A with Group B.

Distribution of Groups A and B and their controls by A-bomb exposure dose (T65D),[4] is shown in Table 6. Cases with unknown dose were excluded and the "less than 1 rad" subgroup was combined with the "not-in-city" subgroup because no significant difference was noted between these two small subgroups. The analysis of dose relationships suggested a significant difference between Group A and its control as well as between Groups A and B (Figure 1). While mean dose was 86.1 rad in Group A, it was only 20.8 and 25.4 rad in its control and Group B ($P < .05$), respectively.

Changes of means of selected findings by examination year were again evaluated for Group A and its control (Table 7). Throughout all years from 1962 to 1968, means for the index subjects tended to be slightly higher than those for controls in four items (i.e., urinary pH, standing height, weight, and diastolic pressure). There was no definite trend in the means of systolic and diastolic pressure. Correlation of both pressure values was specially high ($P < .001$), but no influence of urinary tract

おり約１％であった．なお例数は少ないが，70歳以上において年間発病率が最高であった（2.8％）．

表５は該当群と対照群との間の診察周期年度における特定所見の平均値の比較を示す．種々の所見中には年度により若干有意のものもあるが，尿路感染に関連した統計的有意差はなんら発見できなかった．特に血液学的所見では各年度を通じて重要な傾向を認めなかった．さらに，AおよびB群間について，比較検討を加えたが，結果は同様であった．

いま，A，B群およびそれぞれの対照群において原爆被曝線量（T65線量）[4] による分布をみると，表６のとおりである．そこで，線量不明例を除外し，また１rad未満群は市内不在群との間に有意差のないことからそれら両群を合併し，線量との関係を解析した．その結果，A群とその対照群間，およびA群とB群間ともに線量の有意差が示唆された（図１）．A群の平均線量は86.1 radであったが，対照群およびB群のそれは，各20.8，25.4 rad（いずれも$P < .05$）にすぎなかった．

特定所見平均値の診察年度による推移を，A群とその対照群との間で再度比較検討した（表７）．1962年から1968年に至る全期間を通じて，該当対象者の平均値が対照群のそれよりわずかに高い傾向を示すのは４項目，すなわち尿pH，身長，体重および拡張期血圧であった．収縮期血圧および拡張期血圧の平均値に明確な傾向はなかった．両血圧間の相関は特に高い（$P < .001$）が，尿路感染によ

TABLE 5 COMPARISON OF MEANS OF SELECTED FINDINGS FOR INDEX AND CONTROL BY CYCLE EXAMINATION YEAR

表5　該当対象者および対照群における周期診察年度別特定所見平均値の比較

	Year 年度	Index 該当者			Control 対照者			Significance 有意水準
		Number 数	Mean 平均値	SD 標準偏差	Number 数	Mean 平均値	SD 標準偏差	
Cholesterol mg/100 ml	1962	5	179.4	50.0	3	173.7	14.2	NS
コレステロール	1964	48	202.3	38.9	8	184.8	39.3	NS
	1966	70	200.1	35.3	66	192.5	40.2	NS
	1968	73	184.0	34.1	71	191.7	36.5	NS
Hemoglobin g/100 ml	1962	70	12.4	1.1	66	12.1	1.1	NS
血色素	1964	67	12.2	1.1	69	12.3	1.3	NS
	1966	72	12.0	1.1	67	11.8	1.1	NS
	1968	73	11.9	1.0	70	12.2	1.1	NS
White Blood Cells / mm^3	1962	70	5830	13.6	66	6270	17.5	P＜.10
白血球数	1964	67	5760	14.4	69	5930	17.4	NS
	1966	72	5880	17.1	67	5450	14.3	NS
	1968	73	5480	13.8	70	5690	14.0	NS
Neutrophils %	1962	70	53.8	9.5	66	54.9	8.7	NS
好中球	1964	67	56.4	8.5	69	56.4	9.5	NS
	1966	72	57.2	9.7	67	56.2	10.2	NS
	1968	73	56.1	9.7	70	57.0	9.4	NS
Lymphocytes %	1962	70	35.3	8.6	66	35.6	8.0	NS
リンパ球	1964	67	32.7	8.3	69	33.8	8.6	NS
	1966	72	31.2	8.4	67	33.3	8.4	NS
	1968	73	32.9	9.1	70	32.7	8.3	NS
Urine Specific Gravity	1962	73	1.016	.0056	70	1.016	.0069	NS
尿比重	1964	69	1.015	.0059	73	1.017	.0068	P＜.10
	1966	71	1.016	.0056	72	1.019	.0071	P＜.01
	1968	73	1.020	.0055	73	1.019	.0068	NS
Urine pH (Units)	1962	73	6.1	.8	70	6.0	.8	NS
尿	1964	70	5.9	.8	72	5.8	.9	NS
	1966	71	6.0	.9	72	5.9	1.0	NS
	1968	73	5.9	1.0	73	6.0	1.1	NS
Standing Height cm	1962	72	149.2	6.7	66	148.6	6.4	NS
身長	1964	68	149.0	6.9	70	148.7	5.9	NS
	1966	72	148.8	6.9	67	148.4	6.4	NS
	1968	73	148.7	6.9	73	148.4	6.4	NS
Weight kg	1962	73	49.6	8.7	66	48.6	6.6	NS
体重	1964	68	49.8	9.3	70	49.5	7.1	NS
	1966	72	50.3	10.1	67	49.2	7.4	NS
	1968	73	50.2	9.6	73	50.0	8.8	NS
Systolic Pressure mm Hg	1962	73	127.8	28.0	67	124.8	22.7	NS
収縮期血圧	1964	70	128.1	26.6	70	131.2	25.9	NS
	1966	72	130.0	23.5	67	127.0	21.8	NS
	1968	73	125.1	23.5	73	133.1	29.1	P＜.10
Diastolic Pressure mm Hg	1962	73	78.6	15.7	67	76.8	12.0	NS
拡張期血圧	1964	70	79.6	12.2	70	80.6	12.8	NS
	1966	72	77.1	11.4	67	77.0	12.3	NS
	1968	73	75.8	11.5	73	80.2	13.7	P＜.05
Blood Urea Nitrogen	1962	69	13.2	4.0	4	22.0	13.7	NS
血液尿素窒素	1964	3	14.5	1.9	9	11.9	3.3	NS
mg/100 ml	1966	10	16.7	2.9	7	17.1	4.8	NS
	1968	73	15.2	3.9	70	14.6	4.1	NS

TABLE 6 DISTRIBUTION OF INDEX AND CONTROL BY EXPOSURE DOSE (T65D) AND URINE CULTURE RESULTS, 1968

表 6　該当対象者および対照群の被曝線量（T65線量）ならびに尿培養結果別分類

Exposure 被曝線量	Total 計	Index 該当者	Control 対照者	Total 計	Group A 群	Control 対照者	Total 計	Group B 群	Control 対照者
100 + rad	14	10	4	8	7	1	6	3	3
1 – 99	60	29	31	19	11	8	41	18	23
<1	33	18	15	7	2	5	26	16	10
Dose unknown 線量不明	4	3	1	0	0	0	4	3	1
Not in city 市内不在	35	13	22	14	4	10	21	9	12
Total 合計	146	73	73	48	24	24	98	49	49

TABLE 7 COMPARISON OF MEANS OF SELECTED FINDINGS FOR GROUP A AND ITS CONTROL

表 7　A群とその対照群における特定所見の平均値の比較

	Year 年度	Index 該当者			Control 対照者			Significance 有意水準
		Number 数	Mean 平均値	SD 標準偏差	Number 数	Mean 平均値	SD 標準偏差	
Urine Specific Gravity 尿比重	1962	24	1.017	.0061	22	1.016	.0077	NS
	1964	22	1.016	.0053	24	1.017	.0070	NS
	1966	23	1.017	.0055	23	1.018	.0068	NS
	1968	24	1.021	.0052	24	1.017	.0084	P<.05
Urine pH 尿	1962	24	5.9	.7	22	6.0	.9	NS
	1964	23	6.1	.7	23	5.5	.7	P<.02
	1966	23	6.2	1.2	23	5.6	.9	P<.10
	1968	24	5.9	1.0	24	5.8	.9	NS
Standing Height cm 身長	1962	24	149.0	6.9	22	148.0	7.3	NS
	1964	23	148.9	6.9	23	148.0	7.1	NS
	1966	23	148.6	6.8	20	147.3	7.5	NS
	1968	24	148.5	6.9	24	147.9	7.4	NS
Weight kg 体重	1962	24	52.2	6.9	22	47.7	6.9	P<.05
	1964	23	52.9	6.8	23	48.5	7.9	P<.05
	1966	23	52.6	6.6	20	48.0	7.7	P<.05
	1968	24	52.1	6.2	24	49.6	8.2	NS
Systolic Pressure mmHg 収縮期血圧	1962	24	128.8	25.9	22	125.3	19.8	NS
	1964	23	135.7	26.8	23	127.9	21.4	NS
	1966	23	137.9	25.3	20	127.1	19.5	NS
	1968	24	129.3	22.8	24	133.4	25.5	NS
Diastolic Pressure mmHg 拡張期血圧	1962	24	83.7	18.7	22	76.5	9.6	NS
	1964	23	84.1	10.9	23	79.9	10.1	NS
	1966	23	82.1	10.8	20	75.9	7.5	P<.05
	1968	24	79.3	9.6	24	80.5	12.1	NS
Blood Urea Nitrogen 血液尿素窒素 mg/100 ml	1968	24	16.6	3.8	22	14.1	4.4	P<.05

TABLE 8 PROPORTION WITH SELECTED URINARY FINDINGS FOR GROUP A AND THE CONTROL

表8　A群と対照群における特定検尿所見の比率

Finding 所見	Year 年度	Index 該当者			Control 対照者			Significance 有意水準
		Percent of Total 全体の百分率						
		Negative 陰性	Trace 痕跡	Positive 陽性	Negative 陰性	Trace 痕跡	Positive 陽性	
Proteinuria 蛋白尿	1962	68.0	20.0	12.0	100.0	0.0	0.0	P＜.02
	1964	91.3	0.0	8.7	95.8	4.2	0.0	NS
	1966	75.0	8.3	16.7	100.0	0.0	0.0	P＜.05
	1968	88.0	0.0	12.0	100.0	0.0	0.0	P＜.10
Glycosuria 糖尿	1962	96.0	0.0	4.0	100.0	0.0	0.0	NS
	1964	91.3	0.0	8.7	100.0	0.0	0.0	NS
	1966	95.8	0.0	4.2	95.0	0.0	4.8	NS
	1968	88.0	4.0	8.0	92.0	4.0	4.0	NS
		＜1	1－5	5＋	＜1	1－5	5＋	
White blood cells/hpf 白血球数	1962	24.0	48.0	28.0	73.9	26.1	0.0	P＜.001
	1964	47.8	21.7	30.4	70.8	20.8	8.3	NS
	1966	50.0	37.5	12.5	76.2	4.8	19.0	P＜.05
	1968	20.8	45.8	32.0	84.0	12.0	4.0	P＜.001
Red blood cells/hpf 赤血球数	1962	60.0	36.0	4.0	65.2	34.8	0.0	NS
	1964	96.6	21.7	8.7	54.2	37.5	8.3	NS
	1966	58.3	33.3	8.3	71.4	28.6	0.0	NS
	1968	72.0	28.0	0.0	68.0	28.0	4.0	NS
		Negative 陰性		Positive 陽性	Negative 陰性		Positive 陽性	
Casts/1pf 円柱	1962	88.0		12.0	100.0		0.0	NS
	1964	100.0		0.0	100.0		0.0	NS
	1966	95.8		4.2	100.0		0.0	NS
	1968	92.0		8.0	100.0		0.0	NS

infection on blood pressure was noted. Blood urea nitrogen levels suggested a significant difference from controls ($P < .05$), though the data of only 1968 were available and trends could not be analyzed.

In addition, when urine findings were compared among these groups, significant difference was seen in white blood cells and protein by year. This was especially noted in the number of urinary white blood cells in 1968, when the mean of white blood cells was 4.3/hpf in the average index subjects and 1.2/hpf in controls ($P < .01$). Other findings such as urinary red blood cells, sugar, and casts revealed no significant difference (Table 8).

Multivariate Analysis. The index cases and the controls were compared by tests of mean values by cycle examination year and by contingency table

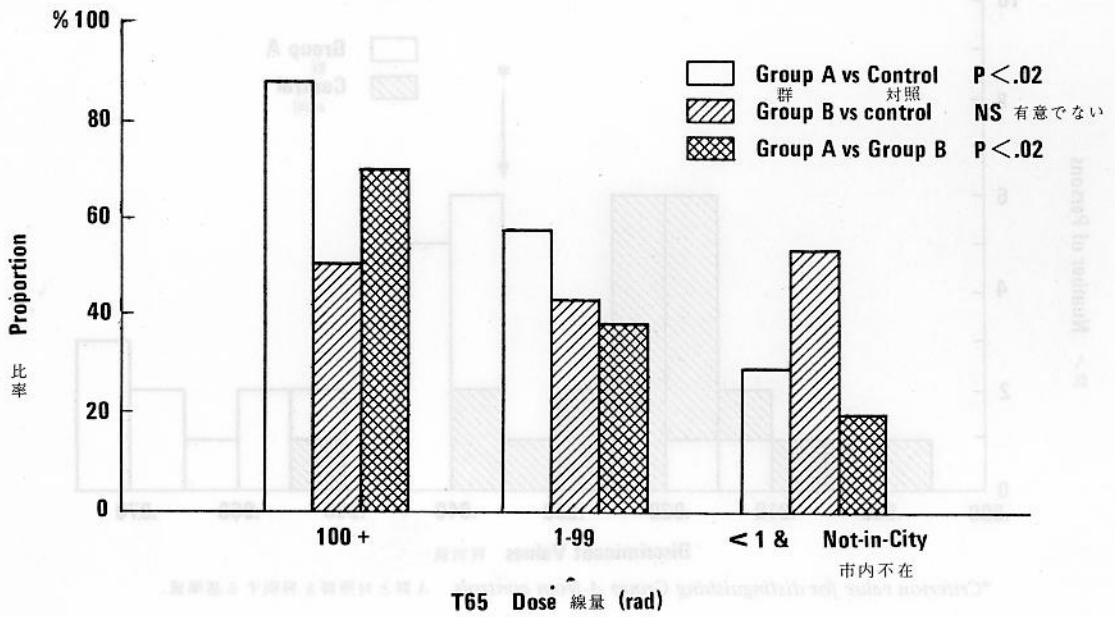
る血圧への影響は認められなかった．血液尿素窒素に関しては，1968年の資料しか利用できないので，傾向を知りえないが，その値は対照群との間に有意差が示唆された（$P < .05$）．

さらに両群間の検尿所見の比較を行なうと，白血球と蛋白に年度により有意差が認められた．特に1968年の尿白血球数に著しく，その平均値は該当対象者の強拡大1視野当たり4.3に対し，対照群では1.2であった（$P < .01$）．その他赤血球，糖および円柱の所見においては，なんらの有意差を示さなかった（表8）．

多変量解析． 該当対象群および対照群間の比較は各診察年度別の平均値の検定と分割表解析によって行なってき

FIGURE 1 PROPORTION BASED ON URINE CULTURE RESULTS IN 1968 BY T65DOSE

図1　T65線量別群における1968年各尿培養結果の比率



analysis. Since several variables are available for each subject for comparison between the two groups, discriminant analysis[5] was also employed as a method which would simultaneously take into consideration a number of important variables.

Ten variables (age, exposure dose, urine specific gravity, urine pH, height, weight, blood urea nitrogen, urinary white blood cells, red blood cells, and protein) were utilized in the discriminant function. Blood pressure, having little relation to UTI, was excluded from the multivariate analysis. All values for Group A and its controls were based on 1968 data. Despite the correspondence of age distributions between Group A and controls, age was included in the discriminant analysis because many of the other factors are strongly related to age. In fact, there is a high correlation between age and blood urea nitrogen ($P < .001$). On the other hand, a high negative correlation exists between age and height ($P < .001$).

A test of whether the mean vectors for Group A and the control group are equal revealed a significant difference at <1% level. Therefore, the discriminant value for each individual in both groups was calculated. Distributions of the resulting score are shown in Figure 2.

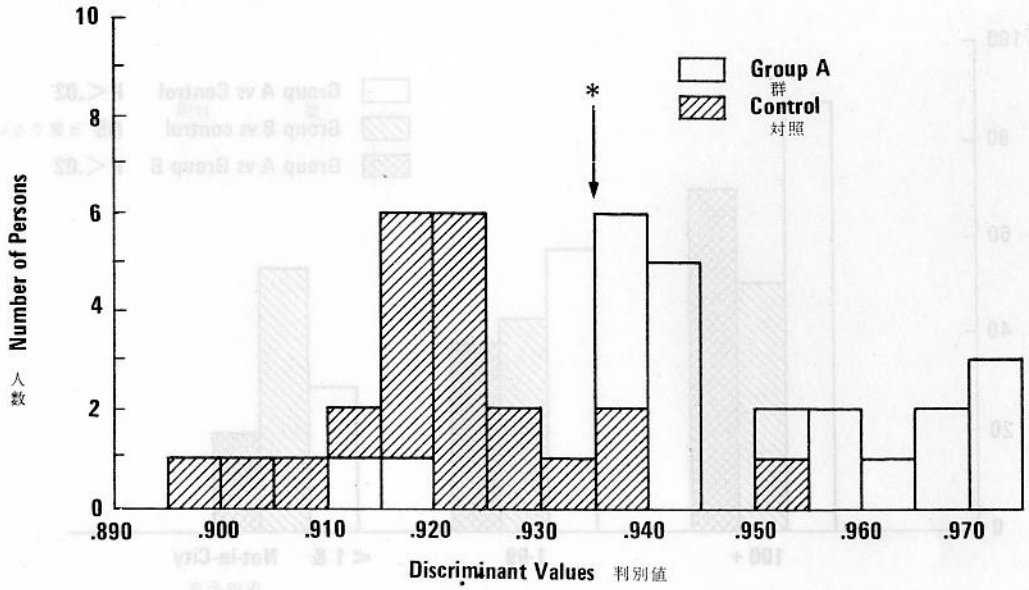
たが，2群間の比較にあたって，各個人の計測値は数項目にわたっているので，一連の重要な変数を同時に考慮して検討する方法として判別関数法[5]を用いてみた．

判別関数作成のため10変数（年齢，被曝線量，尿比重，尿pH，身長，体重，血液尿素窒素，尿白血球，赤血球および蛋白）を利用した．血圧は尿路感染とほとんど関係がなかったため，多変量解析から除外した．A群とその対照群における測定値はすべて1968年の資料をもととした．A群と対照群間の年齢が照応しているはずの年齢を多変量解析に含めた理由は，多数の他因子は年齢ときわめて深い関連性を有するからである．事実，年齢と尿素窒素には高い相関関係があり（$P < .001$），また年齢と身長の関係は高い負の相関を示す（$P < .001$）．

A群とその対照の平均ベクトルが等しいとする検定では，危険率1%以下で両群間に有意差が認められた．したがって，両群の各個人の判別値を求めたが，その数値の分布は図2に示す．

FIGURE 2 DISTRIBUTION OF DISCRIMINANT VALUES FOR GROUP A & CONTROLS

図2　A群とその対照群における判別値の分布



**Criterion value for distinguishing Group A from controls.* A群と対照群を判別する基準値.

The mean discriminant value was .948 in the index cases and .921 in controls using the mean of two groups (i.e., .935, as a criterion for dividing the subjects) the probability of error in discrimination is about 11% (Figure 2).

平均判別値は該当群においては.948，対照群では.921であり，両者の平均値の.935を対象者を分類する判別基準として用いたが，これにより誤まって判別する確率は約11%である（図2）.

If the discriminant coefficient is weighted by the standard deviation of each element, the resulting weighted coefficients indicate the relative importance of each variable in the discriminant. The weighted coefficients are as follows:

各要素の標準偏差によって判別係数を修正すれば，その結果の加重係数は各変数の判別値にどの程度寄与するかの尺度を示すものとなる．加重係数は以下のとおりである.

1.	Age	年齢	−.042
2.	Exposure dose	被曝線量	.062
3.	Specific gravity	尿比重	.047
4.	pH	pH	.034
5.	Height	身長	−.052
6.	Weight	体重	.057
7.	Urea nitrogen	尿素窒素	.020
8.	Pyuria	膿尿	.044
9.	Hematuria	血尿	−.050
10.	Proteinuria	蛋白尿	.049

Thus, no variables have extremely large importance for the discriminant value. Exposure dose is the largest contributory factor, followed by weight,

このように判別値に寄与する極端に大きい加重係数はないが，被曝線量は最大寄与率を有する因子であり，続

height, hematuria, proteinuria, specific gravity, pyuria, age, pH, and urea nitrogen in that order.

Weight and height have high correlation with each other ($P < .001$) and the sign of the weighted coefficients are opposite. While the influence of these two variables would be negligible in a person of average weight and height, the short and obese subjects may have a predisposition to infection.

DISCUSSION

Freedman et al[2] found that approximately 50% of patients with UTI had negative follow-up cultures whether treatment was given or not. In our index (infected) subjects retested about 6 years later, two-thirds had negative cultures. Among 66 who were initially treated, 46 were free of infection and the ratio was about the same as the above figure. However, nearly one-half (29) had repeatedly received antibiotics during the interval. Therefore, it is thought that frequent treatments might have affected the course, as Kunin[6] advocated. On the other hand, of nine originally untreated, four were subsequently treated. Since Kass,[7] treatment of bacteriuria has been discussed and now seems to be justified.[6,8]

In the great majority of persons with persistent infection, the organisms were *E. coli*, in agreement with general experience as in the original study. A change of organisms was seen on follow-up cultures with approximately the same frequency as before. The same bacteria were identified on two successive cultures in almost all cases.

Though intravenous pyelograms were obtained slightly more often than before, the number was still small. It is noteworthy that the degree of pyelonephritis was mild in spite of persistence or recurrence of infection, and there was no sign of progression during the interval. In two cases with apparent persistent infection, autopsy revealed only mild pyelonephritis in each.

The contents of the present questionnaire are somewhat different from the previous one. Although infected patients gave affirmative answers to questions related to flank pain, back pain, dysuria and nocturia, more commonly than controls before, similar questions disclosed no significant difference except for dysuria at this time. It could be expected that there might be a difference in responses to two questions (i.e., episode of UTI and

いて体重，身長，血尿，蛋白尿，尿比重，膿尿，年齢，pH および尿素窒素の順となる．

身長と体重は強い相関を示し（$P<.001$），加重係数の符号が異なる．身長，体重比が標準型の場合，2変数の影響は相殺されるが，短身肥満者は感染を受けやすいといえるかもしれない．

考　察

Freedman ら[2]は尿路感染症患者の約50%は治療の有無にかかわらず，その後尿培養が陰性化することを認めたが，該当（感染）対象者を約6年後再検査した結果，⅔の尿培養は陰性と判明した．前回治療を受けた66名について見れば，今回感染を認めない者は46名でその率は前述のものとほとんど等しかったが，この間治療を重ねた者は半数に近かった（29名）．したがって，Kunin[6]が述べているように，頻回の治療が影響を及ぼしたものと推定される．半面，前回未治療者の9名中4名はその後治療を受けるに至っている．Kass[7]以来，細菌尿の治療が論議されてきたが，現在はその妥当性が認められたものと思われる．[6,8]

感染持続の場合，検出菌の大多数は前回と同様最も一般的に見られる大腸菌であった．追跡調査の培養でも菌の交代現象は前回とほぼ同率の頻度で認められた．しかし，引き続き2回行なった培養では，ほとんど全症例に同一菌が証明された．

経静脈腎盂撮影は前回よりやや高頻度に行ない得たものの依然少数例にすぎない．しかしながら，腎盂腎炎像は感染の持続あるいは再発にもかかわらず軽度であり，前回以来なんら悪化のきざしを呈していないのは特筆に値する．この間感染持続のまま死亡したと考えられる2例の剖検所見は，いずれも腎盂腎炎がきわめて軽微なことを示した．

質問事項は多少前回とは異なるが，以前の感染者に高率であった側腹痛，背痛，排尿障害，および夜間排尿の項目では，排尿障害を除き今回はなんら有意差を認めなかった．尿路感染症および抗生物質治療の病歴の2項に差異

episode of treatment with antibiotics). The fact that positive replies to the latter were significantly more frequent in the index cases than in controls was entirely due to treatment for UTI. If these cases were eliminated, there was no difference at all.

The high incidence of bacteriuria among subjects of 70 years or more was similar to our previous findings, but there was no trend for the incidence to rise after age 60.

Radiation dose was suggestively larger among Group A, compared not only with controls, but with Group B. Although it was rather contrary to the previous report,[2] which showed a suggestively higher success rate after treatment in subjects within 1400 m from the hypocenter, we must wait for further analysis of a large number of cases accumulated so far, before any conclusion is made.[9]

There was no difference of blood pressure between index and controi groups. Even blood pressure among Group A did not show any difference throughout the course, compared with its controls. (Diastolic pressures of infected cases were suggestively higher than that of controls only in 1966, but were lower at the current examination.) This result agreed with Switzer[10] but not with that of Freedman et al.[11] The latter investigators described blood pressure as being higher in women with urinary infection compared with noninfected women. It is important to evaluate the effect of treatment of hypertension on blood pressure. At least the possible effects of therapy for UTI on blood pressure cannot be dismissed, considering the significantly greater use of this among index cases. Moreover, investigation of the nine deceased cases disclosed that eight had been hypertensive, so their exclusion might be prejudicial to the findings. A conclusive statement must be deferred until analysis of a large scale study is possible.

Blood urea nitrogen showed a significantly higher level in Group A, but only a few (4 of 24) exceeded the normal range, and the highest value was 22.9 mg/100 ml. Urinary findings were similar to the previous results in that a significant difference was seen in white blood cells and protein.

Multivariate analysis indicated that estimated A-bomb radiation dose was the largest contributory factor in the discrimination of urinary infection. This may, in fact, be a real finding, or may be the result of case selection or other unknown biases. Our previous study also noted that the crude rate of infection was highest in the proximally exposed group.

のあることは，当然予期されたところである．後者が該当対象群に有意に多いのは，全く尿路感染に対する治療によるものであって，これを除外すれば対照群との間になんらの有意差もなかった．

細菌尿の発病率が70歳以上の対象者において最高であったのは，前回の所見と軌を一にするが，60歳代で上昇する傾向はうかがえなかった．

被曝線量がA群において対照群のみならず，B群と比較しても示唆的に多いのは，爆心地より1400m未満被爆の対象者で治療成功率が示唆的に高かった前回の報告[2]と相反するが，決定的なことは現在まで蓄積された膨大な症例の解析に待たねばならない．[9]

該当対象群と対照群間において血圧の差はなく，A群の血圧さえもその対照群と比較して，期間中を通じ全く有意差を示さなかった（該当対象群の拡張期血圧は，1966年においてのみ対照群より高かったが，これも今周期の診察ではより低かった）．この結果はSwitzerの報告[10]と一致するが，Freedmanらのそれ[11]とは反する．後者は尿路感染婦人の血圧は，非感染婦人に比して高いことを述べている．血圧は治療により変動するものであり，高血圧治療の関与を十分検討しなければならない．少なくとも，該当対象群において抗生物質による治療の頻度が有意に高いことを考慮すれば，尿路感染の治療が血圧に及ぼす影響の可能性も無視することはできない．さらに死亡9例を調査したところ，1例以外全例に高血圧を認めたが，これらの症例の除外が偏った結果を招くに至ったのかもしれない．いずれにせよ，これまた結論は大々的な調査の解析に期待するところである．

血液尿素窒素はA群において有意な高値を示したが，ごく少数のみ（24例中4例）に正常範囲をこえる値が認められ，最高値も22.9mg／100 mlであった．検尿所見で白血球と蛋白に有意差が認められた点は前回の結果と同様であった．

多変量解析によって，推定被曝線量が尿路感染の判別に寄与する最大の因子であることが示された．事実，これはそのままを伝えるものかもしれないが，症例選択あるいは他の不明の偏りからもたらされた可能性も否定できない．前回でも粗感染率は近距離被爆群に最も高かったことを認めている．

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