Diagnosis of Female Genital Tuberculosis by Means of Hysterosalpingography. Especially on the Clinico-Pathological Figures and Progress of Such Disease

I. Observation of Consecutive 192 Cases of Genital Tuberculosis

By

Ryuji Yamaguchi

(山口 龍二)

From the Department of Obstetrics and Gynecology, Faculty of Medicine, Tohoku University, Sendai;

Director: Prof. K. Kushima

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For diagnosis of tuberculosis of the female genitals by findings on hysterosalpingographs (referred to hereunder as HSG), Shinoda¹⁾ and Takahashi²⁾ in Japan and Rozin³⁾ in Europe have laid down classifications of the shadows specific to tuberculosis, but few have studied the development of the disease employing HSG, Ekengren & Rydén's report⁴⁾ being the only one published recently. The present author will report hereunder the pathological findings and development of tuberculosis obtained in our detailed studies of HSG of tuberculosis cases.

Subjects

192 cases with tuberculosis of the genitals treated in 1950–1953 were examined. For confirmation of diagnosis, cultivation of tubercle bacilli from the genitals (from vaginal contents, menstrual blood, and uterine wash⁸⁾) and histological examination of the endometrium and surgically extracted specimens were always applied. As contrast medium, 40% Molojodol (Lipiodol) was used and the roentgenograms taken 5–10 min. and 24 hours after the introduction of the contrast medium were chiefly used for fundamental study.

Types and shadows examined

The 28 types of shadows listed in Table I were examined.

Results

I. Relative frequency of the shadow. Types in the cases with and without genital tuberculosis

TABLE I
Comparison of Appearance Rate of HSG Shadows in
Tbc. and Non-Tbc. Group

Shadows ↓	Group→	Tbc. con- firmed 192 cases	Tbc. not con- firmed, 196	Ratio
Uterine shadows		Out of 240	Out of 199	
Normal uterine cavity		80 (33.3%)	157 (78.8%)	1:2
Small uterus		4 (1.7%)	3 (1.4%)	1:1
Enlarged uterus		8 (3.3%)	5 (2.4%)	1:1
Tiny serration of uterine wall		51 (21.3%)	4 (2.0%)	10:1
Rough serration of uterine wall		10 (4.2%)	9 (4.5%)	1:1
Uterine angiogram		28 (11.7%)	10 (5.0%)	2:1
Dilatation of internal os		5 (2.1%)	2 (1.0%)	2:1
Deformation of uterine cavity		27 (11.3%)	3 (1.4%)	9:1
Atrophy of uterine cavity		22 (9.2%)	5 (2.5%)	4:1
Uterine relief		5 (2.1%)	1 (0.5%)	4:1
Tubal shadows		Out of 619	Out of 426	
Patent tube		31 (5.0%)	195 (45.8%)	1:9
Low-patent tube		7 (1.2%)	53 (12.4%)	1:10
Obstruction at uterine cornu		101 (16.3%)	38 (8.9%)	2:1
Other simple obstruction		18 (2.9%)	45 (10.6%)	1:5
Serration of ampulle		56 (9.0%)	6 (1.4%)	7:1
Relief		103 (16.6%)	21 (4.9%)	3:1
Stricture of ampulle		13 (2.1%)	1 (0.2%)	10:1
Dilatation of ampulle and sactosalpinx		39 (6.3%)	28 (6.6%)	1:1
Round sacculatation		60 (9.7%)	12 (2.8%)	4:1
Ragged isthmic shadow		109 (17.6%)	4 (0.9%)	20:1
Dilatation of isthmus		28 (4.3%)	4 (0.9%)	5:1
Dilatation of interstitial part		20 (3.2%)	5 (1.2%)	3:1
Paratubal opaque invasion		14 (2.3%)	5 (1.2%)	2:1
Peritubal relief		6 (1.0%)	1 (0.2%)	5:1
Fimbrial shadow		11 (1.8%)	0 (1.9%)	1:1
Calcification in tube		3 (0.5%)	0 —	—
Pelvic shadows		Out of 192	Out of 196	
Calcification in pelvic cavity		21 (10.9%)	8 (4.0%)	2:1
Adhesion in pelvic cavity		6 (3.1%)	7 (3.5%)	1:1

Table I shows the rough ratios of the frequencies of the shadows appearing in the roentgenograms of 192 cases with confirmed tuberculosis of the genitals and of 196 cases blindly selected from 904 cases without proven genital tuberculosis as controls. It shows that tiny serrations of

Fig. 1. Schema of Tuberculous Shadows.

the uterine wall, atrophy of the uterus, deformation of the uterine cavity, serration and stricture of the ampulla, serration of the isthmus (ragged-wire-like shadow), round sacculation (cherry-like shadow), tubal relief and various calcification shadows may be deemed as indicative of tuberculosis with considerable reliability and also that uterine angiogram, dilatation of the isthmus, paratubal opaque invasion, and dilatation of the interstitial part are also much more frequent in tuberculous cases.

II. Distribution of combinations of tuberculous shadows

Counting every tuberculous shadow observed as 1 item and two shadows of the same type as 2 items, the distribution of the frequencies of more than one tuberculous shadows in coexistence was as shown in Table II. When the number of tuberculous-type shadows found in one individual case becomes large existence of tuberculosis becomes the more probable, and when 5 or more tuberculous shadows coexist, diagnosis of tuberculosis becomes well-high infallible.

TABLE II
Distribution of Combination Number of "Tbc. Shadows"

Combination No.	0	1	2	3	4	5	6	7	8	9
Tbc. not confirmed, 196 cases	129	31	17	14	5	1	1	0	0	0
Tbc. confirmed, 192 cases	17	21	35	36	24	24	15	10	6	3

III. Classification and correlation of the HSG findings in tuberculosis

As previously reported by the present author⁹⁾⁽¹⁰⁾, the cases of female

genital tuberculosis can be classified into the following three major groups based upon HSG findings: Group I showing perceptible change in neither the uterus nor the fallopian tubes and with the tubal patency intact, Group II with various tubal changes but not marked uterine change and Group III with advanced changes in the uterus too. The salpingographic findings are apparently classifiable into two representative types again: Type A with changes more notable in the ampulla and Type B with changes more notable in the isthmus. The above classifications will be referred to hereunder in studying how they match with the development of genital tuberculosis.

1. *Change in Various Shadows*; As seen in Table III, a peculiar change in the ratios of the various shadow types appears when we go over from Group I to Group II. The correlation between the changes in the uterus and the several representative types of tubal changes in combination was as shown in Table IV.

TABLE III
Three Group Classification and Shadow Transition

Tbc. shadow ↓ HSG group →	I (15 cases)	II (131 cases)	III (39 cases)
Patent tube	13 < both one 12 1	4 < both one 2 2	0
Low patent tube	2 < both one 1 1	3 < both one 1 2	0
Obstruction at uterine cornu	0	45 < both one 10 35	25 < both one 18 7
Tbc. tubal shadow Type-A	4 < both one 4 0	37 < both one 27 10	1 < both one 0 1
Tbc. tubal shadow Type-B	0	56 < both one 33 23	18 < both one 10 8
Tbc. uterine shadow	3 < slight manifest 3 0	56 < slight manifest 49 7	39 < slight manifest 1 38
Calcification in pelvic cavity	0	11 (8.4%)	10 (25.6%)
Adhesion in pelvic cavity	1	4	0
Culture positive cases	14	98	33
Average of colony (Median)	1.5	2.5	4.0

* 7 cases which are difficult to classify are excluded

From these findings, we might reasonably conclude that 1) tubal obstruction does not suddenly arise at the uterine cornu but develop from the ampulla to the cornu, 2) the decrease of A type tubal shadows with

TABLE IV
Relation between Uterine and Tubal Changes

Tubal shadow ↓	Intensity of ut. change (case)→	Normal ut. shadow (80)	Tiny serration of ut. wall (30)	Other tbc. ut. shadow with tiny serration (60)
Serration of ampulle		11.7%	11.4%	6.0%
Tubal relief		25.5%	19.1%	4.5%
Dilatation of ampulle		6.7%	8.4%	2.8%
Ragged isthmic shadow		14.4%	25.7%	28.8%
Round sacculatation		11.4%	11.9%	10.6%
Obstruction at ut. cornu		7.4%	8.9%	40.2%
Patent tube		7.7%	2.9%	0
Other tubal shadows		16.2%	11.7%	7.1%

the increase of uterine changes is partly attributable to the progress of tubal obstruction but 3) partly suggests that Type B changes are older in time than Type A changes. The gradual increase in frequency of calcification shadows in the pelvic cavity from Group I to Group III shows that the latter is the oldest in age.

2. *Bacillous discharge in the three groups*

As shown in Table III, the cultivation tests showed nearly always positive results in Group I, because the cases of this group can be seldom detected except by bacillar cultivation. In Group II and III too, positive cases were more frequent but negative cases were not at all rare, and in particular, Group II included about one-fourth of negative cases. Such negative results have been hitherto attributed to defects in cultivation or effects of the menstrual cycle, but we were inclined to infer existence of closed type in genital tuberculosis as in tuberculosis of other sites, and studying the factors leading to such negative bacillus discharge on HSG, arrived at the results in Tables V, VI and VII.

TABLE V
Results of Culture of Vaginal Tbc. Bacilli and HSG Changes
of Tubes and Uteri in 2nd Group of HSG (93 Cases)

HSG→ Culture ↓	Tbc. involved uteri		Not involved uteri	
	Tubal shadow-A	Tubal shadow-B	Tubal shadow-A	Tubal shadow-B
Positive culture	8	22	21	21
Negative culture	3	4	5	9
Total	11	26	26	30

TABLE VI
Results of Culture of Vaginal Tbc. Bacilli in The View-
Point of Menstrual Cycle and Uterine and Tubal
Changes in Second Group of HSG (23 Cases)

	With tiny serration of uterine wall			Without tiny serra- tion of uterine wall		
	Tubal shadow type-A	B	A+B	A	B	A+B
Positive culture only at premenstrual and menstrual stadium	3	3	1	2	5	1
Positive culture throughout menstrual cycle	2	2	1	2	0	1

TABLE VII
Results of Culture of Vaginal Tbc. Bacilli and Intensity of
Uterine Involvement in Third Group of HSG (39 Cases)

	Positive culture			Negative culture
	Total	Average of colony		
		Over 3	Under 3	
Marked destroyed	15	11	4	3
Not so destroyed	11	6	5	2
Atrophied or deformed	7	1	6	1

As factors affecting the discharge of bacilli in the vagina, we may find 1) the menstrual cycle, as already pointed out in the past, 2) grade of uterine involvement and 3) the findings of the fallopian tubes. As shown in Table V, in Group II of cases almost all free of menstrual anomalies, the discharge of bacilli is seen to be influenced by the presence of anomalies in the uterus, especially, of tiny serrations in the uterine wall, and among the cases free of uterine anomalies, as shown in Table VI, positive cultures are found more frequent among the cases with Type A tubal pictures than those with Type B tubal pictures, both just before menstruation and in the intermenstrual periods. In the Group III of cases with various anomalies in the uterus, as shown in Table VII, the severity of such uterine changes influences both the frequency of positive cases and the quantity of the bacilli in the culture, but in the case the uterine anomalies chiefly consist in its atrophy or deformation, the bacillus discharge is low. From this, we conclude that the Group III may be subdivided into Type A cases with minute serrations or angiograms and Type B cases with uterine atrophy or deformation chiefly appearing on their HSG. Now, as 17 of

the 39 cases in Group III were amenorrheic and the majority of the others hypomenorrheic, it may be presumed that the influence of the menstrual cycle was scarcely felt in the figures in Table VII.

IV. *Tiny serrations in the uterine wall*

Of all the uterine findings in tuberculosis of female genital organs tiny serrations in the uterine wall are the most fundamental and were found in 25% of our tuberculous cases. Upon closer examination of these serrations, they were found particularly frequent in the fundus of the uterus (Table VIII).

TABLE VIII
Tiny Serration of Uterine Wall

	Fundal serration alone	Fund. serr. intensive, cor- poral serration slight	Corporal serr. alone	Corp. serr. intensive, fund. serr. slight	Serr. of all ut. wall
With other uterine shadows	2 (10.5%)	1 (5.2%)	0	0	16 (84.3%)
Without other uterine shadows	10 (23.3%)	12 (27.9%)	6 (13.9%)	1 (2.3%)	14 (32.6%)

From this, it may be inferred that the fundamentalmost type of such uterine serrations is those in the fundus uteri, and very probably such fundal serrations are the incipient type of all endometrial serrations. Clinically speaking, we may recommend to select the fundus in diagnostic endometrial curettage as the most promising point of attack.

SUMMARY

Since methods for successful cultivation of tubercle bacilli from genital organs were established more than a dozen years ago (Shinoda & Iwabuchi⁵⁾, 1941; Furuhashi⁶⁾, 1947; Halbrecht⁷⁾, 1947; Yamaguchi⁸⁾, 1952), studies on genital tuberculosis have been encouraged and minute schedules of classification of tuberculous findings based on HSG have been undertaken by Shinoda & Takahashi²⁾ (1943), Kika, Yamaguchi, *et al.*⁹⁻¹²⁾ (1951) in Japan and noteworthy reports on the subjects have appeared in Europe too, of Magnusson¹⁴⁾ (1945, 1947), Rozin³⁾ (1952, 1954), Ekengren & Rydén⁴⁾ (1952) and some others¹⁵⁾¹⁶⁾¹⁷⁾.

On the correlation, however, between the different types of tuberculous HSG shadows, their combination and the relation of the findings to discharge of tubercle bacilli we have no report available to date. We have once discussed the pathological pictures and development of genital tuberculosis classifying the cases with the disease into three groups with consideration to the results of cultivation of tubercle bacilli and endometrial

biopsy (Kika, Yamaguchi, *et al.*⁹⁾, 1952) and in the present paper, have described the existence of Type A and B among the representative types of tubal findings on HSG, discovered in our closer examination of the HSG of tuberculous cases. From considerations on some relevant findings, we are led to conclude that the Type A findings are younger than the Type B findings and it seems the former develops eventually into the latter. The fundamental type of uterine findings was inferred to consist in the tiny serrations in the uterine walls, which first arise in the fundus near the uterine cornu and gradually spread all over the uterine wall.

There has been no report on the development of genital tuberculosis studied from the angle of HSG findings, except that by Ekengren & Rydén⁴⁾ (1950) on the progress of tubal tuberculosis. Their results are in rather good agreement with the ours, but we must state with regret that they failed to study the subject from the bacteriological angle and to review the results in comprehensive discussion with the uterine and the pelvic roentgenographic findings. Our study, we hope, may serve in supplementing some of the shortcomings of their studies.

CONCLUSIONS

1. The HSG of 192 cases with genital tuberculosis encountered in these 4 years were examined thoroughly, to discuss the pathological findings and development of the disease.

2. In divergence from the opinion accepted hitherto, we found the diagnostic accuracy obtained by examination of HSG in genital tuberculosis cases is very high, if we take the number of tuberculous findings in coexistence and the combination types of such findings into account.

3. The outstanding combination types of findings in tubal tuberculosis can be classified into the Type A represented by serration in the ampulla and tubal relief and Type B represented by raggedness of the isthmus and round sacculution (cherry-like shadows). Many findings led us to conclude that the Type A temporally precedes Type B.

4. Among the tuberculous uterine findings, tiny serrations in the uterine wall were found the fundamental anomalies. These arise in the fundus and thence gradually spread all over the uterine wall. The uterine anomalies too can be classified in considerations on the results of cultivation of bacilli etc. into Type A with serration and angiograms as the main findings and Type B represented by atrophy and deformation of the uterus. Here, Type A seems to represent the fresher changes than Type B.

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Fig. 2-a. (B-2334)
HSG classification group.
I-A: No pathological change.

Fig. 2-b. (B-2061)
I-B: Tubal patency is still maintained, but slight change of tubes is already seen, especially in the left side.

Fig. 3-a. (B-2185)
II-A: Distinct ampullar findings are visible (Serratation, dilatation and relief) but the isthmus and the uterus are normal.

Fig. 3-b. (B-2995)
II-B: Excessive changes of isthmus (ragged isthmic shadow, round sacculations), and serratation of uterine wall and dilatation of internal os are also present.

Fig. 4-a. (B-2291)

III-A: Typical uterine angiogram.

Fig. 4-b. (B-3249)

III-B: Deformation and atrophy of uterus with slight uterine angiogram.