# CLINICAL STUDIES ON INTRAUTERINE RINGS

## ESPECIALLY THE PRESENT STATE OF CONTRACEPTION IN JAPAN AND THE EXPERIENCES IN THE USE OF INTRAUTERINE RINGS

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### Introduction

Contraception has been encouraged in Japan by every means since the World War II, as she has had a serious problem of the natural increase of her population. On the other hand, indication of induced abortion has greatly spread after the war to the extent of social and economical indications besides medical. For this reason, contraception is not much popularized, however it is encouraged. The present state of contra-

Table 1. The present state of contraception in Japan.

| No. | Author | Year | Total number | Practiced number | % |
|---|---|---|---|---|---|
| 1 | Tanaka | 1950 | 900 | 102 | 11.4 |
| 2 | Kimi | 1950 | 6,747 | 1,754 | 26.0 |
| 3 | Tahata | 1951 | 4,054 | 1,267 | 31.8 |
| 4 | Kojima | 1951 | 1,760 | 517 | 29.4 |
| 5 | Kojima | 1951 | 412 | 41 | 10.0 |
| 6 | Sakai | 1952 | 1,060 | 307 | 29.0 |
| 7 | Hori | 1952 | 530 | 147 | 27.7 |
| 8 | Hika | 1952 | 3,760 | 1,224 | 32.6 |
| 9 | Fukita | 1952 | 1,384 | 509 | 36.9 |
| 10 | Takeda | 1952 | 2,115 | 680 | 32.0 |
| 11 | Terauchi | 1952 | 4,539 | 2,225 | 49.0 |
| 12 | Moriyama | 1952 | 1,902 | 454 | 23.9 |
| 13 | Komiyama | 1952 | 351 | 48 | 13.7 |
| 14 | Yasui | 1953 | 9,980 | 6,410 | 64.2 |
| 15 | Ishihama | 1953 | 623 | 194 | 31.2 |
| 16 | Nagao | 1953 | 1,558 | 805 | 51.7 |
| 17 | Sugimoto | 1953 | 700 | 242 | 38.4 |
| 18 | Furuya | 1953 | 418 | 78 | 18.7 |
| 19 | Ogino | 1953 | 716 | 106 | 14.8 |
| 20 | Ishihama | 1955 | 2,527 | 574 | 22.7 |

ception reported is summarised in Table 1. Only 30% (average) are practising it.

The main reasons for the difficulty of popularizing contraception seem to be the followings:

1. As it has been stated above, many people think that contraception is an artificial interruption of pregnancy and induced abortion can be made so easily.
2. There is no reliable, harmless and cheap method of contraception.
3. Every method hitherto used disturbs sexual intercourse to some extent.
4. The structure of Japanese houses is not befitting for the use of contraceptives.

Table 2 shows five methods of contraception used in this country in the order of their popularization: they are used in the order of condom, periodic continence (OGINO method), and contraceptive medicine. Diaphragm pessary is not much used in Japan.

Table 2. Contraceptive method used in Japan.

| No. | Author | Order | | | | |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | V |
| 1 | Kubo | Condom 21.0 (%) | Ogino's method 12.3 (%) | Ogino+contracept. 8.7 (%) | Contraceptive 5.3 (%) | Coitus interrupt. 5.3 (%) |
| 2 | Komiyama | Ogino 41.7 | Condom 39.6 | Pessary 10.4 | | |
| 3 | Kimi | Ogino 42.6 | Condom 17.0 | Contraceptive 16.1 | Another method 12.0 | |
| 4 | Fukida | Condom 41.0 | Ogino's M 30.8 | Contraceptive 16.4 | Ring 11.2 | |
| 5 | Terauchi | Ogino 19.5 | Condom 17.5 | Condom+Ogino 13.9 | Contraceptive 8.6 | Pessary 4.4 |
| 6 | Sugimoto | Condom 23.7 | Ogino 22.7 | Condom+Ogino 21.0 | Pessary+contrac. 8.6 | Condom+contrac. 4.1 |
| 7 | Shinozaki | Condom 63.7 | Ogino 41.0 | Contraceptive 25.3 | Coitus interrupt. 13.4 | Pessary 11.5 |
| 8 | Moriyama | Contracept. 34.4 | Condom 20.8 | Ogino 12.5 | Condom+Ogino 7.9 | Contraceptive 6.1 |
| 9 | Hika | Ogino 31.4 | Condom 31.5 | Pessary 8.7 | Contraceptive 20.3 | Coitus interrupt. 8.1 |
| 10 | Tabata | Condom 32.4 | Ogino 14.1 | Contraceptive 28.6 | Pessary 10.0 | Coitus interrupt. 4.1 |
| 11 | Nagao | Condom 46.2 | Ogino 29.8 | Ogino+condom 23.5 | Contraceptive 7.1 | Condom+contrac. 5.7 |

Table 3. Effect of contraceptive methods (Result from Japanese Institute of Population Problems).

| Method | Number | Success (%) |
|---|---|---|
| Condom | 115 | 58.3 |
| Ogino's method | 70 | 55.7 |
| Coitus interruptus | 37 | 6.2 |
| Ogino's method+condom | 27 | 66.7 |
| Another method | 79 | 57.9 |
| Average | 286 | 48.6 |

Varying effects have been reported. However, this appears to be rather due to the insufficient knowledges, incorrect use of con-

traceptives delinquency in use, or to the use of the various kinds of materials. The results which have been reported from the Japanese Institute of Population Problems are as shown in Table 3.

I have chosen so-called "intrauterine rings" as a method of contraception. These are inserted by doctors of the field; therefore the way of their use is always the same, and the effects can be judged easily and accurately. So, I have done this study in the hope that if intrauterine rings are effective at all, those who have difficulty in the practice of contraception can use them and get some effects from them.

A woman who has some foreign body in the uterus does not readily conceive. We can see it in the fact that myoma uteri makes a cause for sterility. UCHIGAKI (1928) succeeded in the experimental sterility implanting a piece of cartilage on the uterine wall of a rabbit. GRAEFENBERG (1928) succeeded in the experimental sterility inserting a foreign body in the uterus. Later, this experiment was repeated by LEHLFELD, HAIRE, RETSMERSKY, LEUNBACH, CARLETON and PHELPS. In our country, OTA (1932) repeated it around the same time. It was PUST who experimented it on the human uterus for first time. He inserted a ring of silk thread in the uterus and applied its glass board to the portio vaginalis. GRAEFENBERG thought that the parts of the instrument which were to be applied to the cervical canal and the portio vaginalis were not only unnecessary but also would increase infection. Therefore, he advocated a ring of silk thread or silver line was to be placed only in the uterus. This was called GRAEFENBERG's ring. Many experiments were made on GRAEFENBERG's ring by KLEIN, LEUNBACH and ANDREW, and they opposed to it as it caused endometritis. In our country, too, some scholars still oppose to the contraception by means of rings. This method seems pretty popularized in actuality, however, as it is best adapted to the Japanese way of life and also it does not harm so much as it is supposed. The effects of intrauterine rings which I have examined recently will be reported as follows:

## RESULTS OF EXPERIMENTS

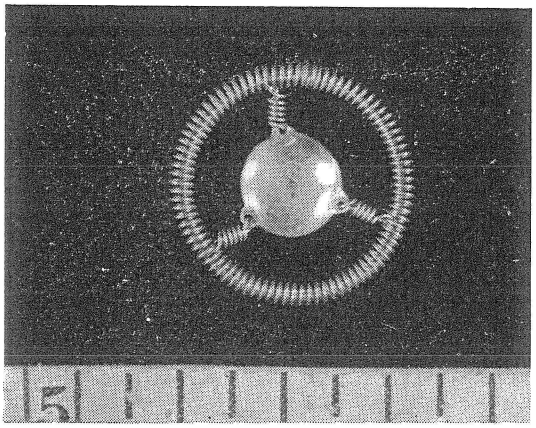

Fig. 1. Ota metallic ring.

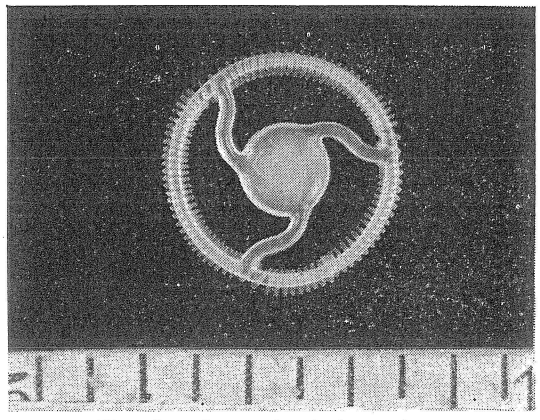

Fig. 2. Ota polyethylene ring.

623 cases of OTA metallic rings (data A, Fig. 1) and 350 cases of OTA polyethylene rings (data B, Fig. 2) which I inserted by myself, and 18,594 cases reported from 149 hospitals in Japan (data C) were used in this study. The courses after the insertion in data A, B, C are shown in Table 4. The relation between the time of insertion and the courses was also studied as the rate of disturbances seemed to be varied depending on the time of insertion (Table 5).

Using data A, B, C, I have made some investigations on intrauterine rings, dividing into following items:

Table 4. Evaluation of result.

A) The course after insertion of 623 cases of metallic rings.

| Course after insertion | Cases | % |
|---|---|---|
| Non-disturbance | 440 | 70.6 |
| Slight disturbance | 155 | 24.2 |
| Removed ring due to serious disturbance | 33 | 5.2 |
| Total | 623 | 100.0 |

B) 350 cases of polyethylene rings.

| Course after insertion | Cases | % |
|---|---|---|
| Non-disturbance | 280 | 80.0 |
| Slight disturbance | 58 | 16.5 |
| Removed ring due to serious disturbance | 12 | 3.5 |
| Total | 350 | 100.0 |

C) 18,594 cases reported from different hospitals.

| Course after insertion | Cases | % |
|---|---|---|
| Non-disturbance | 14,570 | 78.4 |
| Slight disturbance | 4,024 | 21.6 |
| Removed ring due to serious disturbance | Unknown | |
| Total | 18,594 | 100.0 |

Table 5. Relations between side-effects and inserting time.

A) 623 cases of metallic rings.

| Course \ Insertion time | Post-menstruation | Interval | Before menstruation | Directly after induced abortion | Few days after induced abortion | During puerperium | Total |
|---|---|---|---|---|---|---|---|
| Non side-effect | 271 | 58 | 15 | 3 | 54 | 39 | 435 |
| Slight disturbance | 30 | 4 | 2 | 46 | 43 | 25 | 150 |
| Removed ring due to serious disturbance | 6 | 0 | 2 | 13 | 6 | 6 | 33 |
| Total | 307 | 62 | 19 | 62 | 103 | 70 | 623 |

B) 350 cases of polyethylene ring.

| Course \ Insertion time | Post-menstruation | Interval | Before menstruation | Directly after induced abortion | Few days after induced abortion | During puerperium | Total |
|---|---|---|---|---|---|---|---|
| Non side-effect | 56 | 35 | 14 | 157 | 7 | 11 | 280 |
| Slight disturbance | 10 | 0 | 2 | 31 | 12 | 3 | 58 |
| Removed ring due to serious disturbance | 0 | 0 | 1 | 6 | 3 | 2 | 12 |
| Total | 66 | 35 | 17 | 194 | 22 | 16 | 350 |

## 1. Relations between conception and rings

### a. Frequency of conception

The frequency of conception in two years after the insertion of rings is shown in Table 6: 8 of 623 cases (1.2%) in data A, and 6 of 350 cases (1.7%) in data B. In data C 425 of 18,594 cases (2.2%) conceived, but the period of observation in these data was longer than two years. However, these results alone, which were obtained by observations for only two years, may not be sufficient to indicate all about the effect of intrauterine rings. Therefore, I have calculated the rate of conception in 350 cases of data B by STIX-NOTESTEIN's method.

Table 6. Frequency of conception during insertion of ring.

| Material | Total | Conception | % |
|---|---|---|---|
| A | 623 | 8 | 1.1 |
| B | 350 | 6 | 1.7 |
| C | 18,594 | 425 | 2.2 |

Rate of conception before contraception is practiced:

$$E = \frac{a}{b} \times 1{,}200$$

$a$: Total conceptions before contraception is practiced.

$b$: Total months available for conception before contraception is practiced
=(married period)−(months during fetuses are in the uterus).

Rate of conception after contraception is practiced:

$$H = \frac{c}{d} \times 1{,}200$$

$c$: Unexpected conceptions after contraception is practiced (failure).

$d$: Total months available for conception after contraception is practiced.

The results obtained by the above formulas is as follows:

$a$: Total conceptions before the insertion of rings=1,400.

$b$: Total months available for conception before the insertion of rings=(married months)−(months during fetuses are in the uterus)=33,142−(8,300 + 1,700)=23,132 (months).
deliveries abortions

$c$: Total conceptions after the insertion of rings (failure)=6.

$d$: Total months available for conception after the insertion of rings=2,867 (months).

$$E = \frac{1{,}400}{23{,}132} \times 1{,}200 = 72.6$$

$$H = \frac{6}{2{,}867} \times 1{,}200 = 2.5$$

The rate of conception before the insertion of rings is 72.6 and the one after the insertion is 2.5.

The effect of contraceptives is generally figured in the following way:

$$\frac{E-H}{H} \times 100 = \text{effectiveness}$$

Therefore the effect of rings is:

$$\frac{E-H}{H} \times 100 = \frac{72.6-2.5}{72.6} \times 100 = 96.5\ (\%)$$

That is 96.5%.

**b. How intrauterine rings act contraceptively**

It is still unknown why a ring prevents contraception. OTA explained that a spermatovum was disturbed by the ring from being buried when it was to be implanted on the endometrium. GRAEFENBERG said that the existence of a foreign body caused non-inflammatory hypertrophy of the endometrium and that disturbed the implantation of a spermatovum. CARLETON and PHELPS explained that the oppression by a foreign body caused necrosis of the endometrium. However, histological figures like inflammation, necrosis, hypertrophy and atrophy are not always seen on the endometrium. Besides, polyethylene and nylon rings which do not cause so much oppression and necrosis as metallic rings are even more effective than metallic ones. SUZUKI, RETSCHMERSKY and others stated that the chemical activities of metal and the change of pH were the cause of sterility. Again it is hard to agree with this opinion as the effectiveness of rings do not differ by the materials: metal, nylon and polyethylene. Therefore it is probably most appropriate to think that intrauterine rings act contraceptively simply by the mechanical activities of their own.

**c. Investigations on the cases of conception**

As already stated there are some cases of conception even after the insertion of

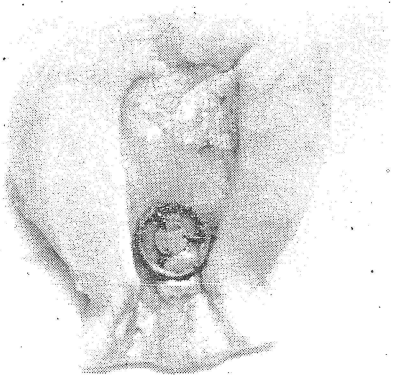

Fig. 3-a. Ring which is inserted in a enlarged uterus.

Fig. 3-b. X-ray picture of the same uterus.

Fig. 3-c. Correct insertion.

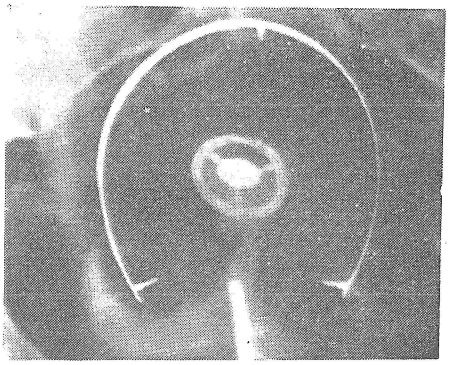

Fig. 3-d. X-ray picture of the same uterus.

rings. It is impossible to find the exact reason for such conception, because we do not know how the rings act contraceptively. Investigating the cases of conception, however, I have found that conception occurs often in the following instances: 1) when a ring is inserted after induced abortion (Fig. 3, a, b, c, d), 2) when prolapses of ring is unnoticed and 3) when a ring is not inserted in the uterus properly as it does not fit the size of the uterus (Fig. 4). In data A, 8 of 623 cases conceived. In 4 cases of these the rings were inserted after induced abortion. In data B, 6 of 350 cases conceived. Rings were inserted after induced abortion in all cases. It is considered that when a ring is inserted into the enlarged uterus by pregnancy, it will go down and a space is made between the ring and the uterus. A spermatovum can be implanted there. Figs. 5 are supposed figures when rings are inserted in the various shaped uteri.

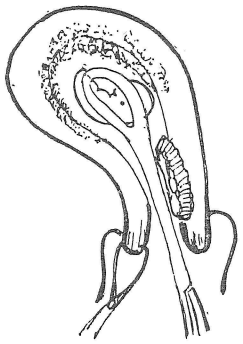

Fig. 4. Ring which is inserted in the cervical canal.

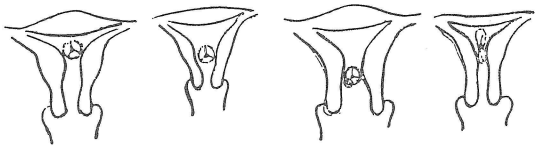

Fig. 5. Supposed figures when rings are inserted in the various shaped uterus.

**d. Time of conception**

As is shown in Table 7, conception occurs mostly in one or two years after the insertion of rings. Therefore it will be rash premature to critisize the effect of the contraception by rings within two years.

Table 7. Time of conception.

| Time of conception | Material | | |
|---|---|---|---|
| | A | B | C |
| One month | 0 | 0 | 0 |
| 2～6 // | 1 | 1 | 36 |
| 7～12 // | 2 | 2 | 170 |
| 1～2 year | 5 | 3 | 201 |
| 2～3 // | 0 | 0 | 16 |
| 3～5 // | 0 | 0 | 0 |
| 5～7 // | 0 | 0 | 0 |
| Total | 8 | 6 | 425 |

**e. Conception after removal of rings**

A ring is used for the purpose of temporary contraception; therefore it must be the one which enables conception after its removal. Table 8 shows the cases in which conception occurred immediately after rings were taken out. It might be rash to conclude the effect of rings, with these few cases alone. However, all the women conceived several times before, but not 1 to 4 years after ring-insertion, and all conceived within 2～3 months after removal of the rings. Therefore we may attribute it to the effect of rings. Especially three of these five cases conceived the next months after the rings were taken out. Case 3 was removed of

Table 8. Conception after removed rings.

| Cases No. | Name | Profession | Frequency of conception | Date of insertion | Time of insertion | How long inserted | Date of removed ring | Remove why | Conceive within |
|---|---|---|---|---|---|---|---|---|---|
| 1 | T. Z. | Mine-worker | 4 | Dec. 1948 | After mens. | 4 years | May 1952 | Except conception | 3 months |
| 2 | T. F. | Government official | 3 | Dec. 1952 | | 1 year | Dec. 1953 | | 2 months |
| 3 | N. K. | // | 1 | Nov. 1952 | Directly after abortion | 8 months | July 1953 | Slightly bleeding | 3 months |
| 4 | T. K. | Farmer's wife | 5 | Nov. 1953 | Interval | 1 year | Jan. 1955 | Exchange ring | 1 month |
| 5 | K. M. | // | 4 | July 1949 | // | 3 year | Sept. 1952 | Hope for baby | 2 months |

the ring owing to continous bleeding since the insertion, and then conceived. From this fact we may think that even when there was some disturbance during the use of a ring, no after-effect is left after the ring is taken out and she can conceive again. The cases which I have experienced by myself are very few, but similar observations have been reported by many workers. For instance, TORII reported that 94.7% of 151 cases conceived within 6 months after rings were taken out. MURAKAMI also reported that a woman who had a ring for seven years conceived right after the ring was removed. Many others have reported similar experiences.

## 2. On side-effects of rings

### a. Frequency and details of side-effects

The frequency of side-effects in data A, B and C is shown in Table 4. In data A, 183 of 623 cases (29.4%) had some disturbances and rings were removed in 33 cases (5.2%) for that reason. In data B, 58 of 350 cases (16.5%) had some disturbances and rings were taken out in 12 cases (3.5%). In data C, 4,024 of 18,594 cases (21.6%) complained of disturbances, but the number of cases in which rings were removed was unknown. Thus 16.5~29.2% (average 23.4%) had some disturbances, but some of these were very light, and it was only 3~5% that had to have rings taken out because of the serious disturbances. The details and kinds of disturbances are shown in Table 9. Main disturbances were menstrual disorders, hemorrhagic discharge, atypical vaginal bleeding, hypogastric pain, lumbago, and a few nervous symptoms. Let us investigate on each of them.

### b. Menstrual disorders

After the insertion of rings, the increase of menstrual discharges and the extension of menstrual periods were often seen. These were seen in 19.2% in my experiments. The actual percentage must be higher as the patients with light symptoms did not come for examination. The cause is unknown, but it is considered that the regenera-

Table 9. Details of side-effects after insertion.

A) 623 cases of metallic rings.

| Symptoms / Degree | Hyper-menorrhoe | Atypical bleeding | Pain | Discharge | Examina-tion | Concep-tion | Another symptoms | Total |
|---|---|---|---|---|---|---|---|---|
| Slight | 112 | 14 | 9 | 3 | 9 | 0 | 3 | 150 |
| Serious | 6 | 10 | 4 | 3 | 0 | 8 | 2 | 33 |
| Total | 118 | 24 | 13 | 6 | 9 | 8 | 5 | 183 |

B) 350 cases of polyethylene rings.

| Symptoms / Number | Hyper-menorrhoe | Atypical bleeding | Pain | Discharge | Wish to examina-tion only | Conception | Another symptoms | Total |
|---|---|---|---|---|---|---|---|---|
| Slight | 36 | 10 | 9 | 1 | 2 | | 0 | 58 |
| Serious | 0 | 4 | 1 | 1 | 0 | 6 | 0 | 12 |
| Total | 36 | 14 | 10 | 2 | 2 | 6 | 0 | 70 |

C) 18,594 cases from different hospitals.

| Symptoms / Number | Hyper-menorrhoe | Atypical bleeding | Pain | Discharge | Fever | Concep-tion | Another symptoms | Uncer-tainty | Total |
|---|---|---|---|---|---|---|---|---|---|
| Cases | 1,318 | 942 | 456 | 387 | 7 | 425 | 16 | 173 | 4,024 |

tion of the ablated endometrium is disturbed by rings. These disturbances, however, are often seen only in the first two or three menstruations, and then become normal after that. Disturbances are seen less when polyethylene rings are used.

**c. Atypical vaginal bleeding**

Atypical vaginal bleeding is the most unpleasant side-effect which can be called the weak point of rings. The frequency was 3.5% in data A, 2.8% in data B, and 4.3% in data C. HASHIMOTO reported that 28 of 868 cases (3.2%) had metallic rings. Therefore, it seems impossible to avoid 3~5% of hemorrhagic discharge or atypical vaginal bleeding. The frequency varies depending on the kinds of rings, ways of insertion and time of insertion. It is seen especially often when rings are inserted after induced abortion. The three cases in Table 10 had heavy bleeding by the insertion

Table 10. Heavy bleeding cases during insertion.

| Case No. | Name | Age | Profession | Conception | Date of insertion | Time of insertion | Notice |
|---|---|---|---|---|---|---|---|
| 1 | K. U. | 25 | Worker | 3 | Feb. 2, 1953 | Directly after abortion | |
| 2 | S. S. | 39 | Teacher | 3 | April 2, 1953 | Before mens. | Abortion? |
| 3 | S. H. | 26 | Worker | 4 | May 9, 1953 | After mens. | |

of rings after induced abortion. If the bleeding is caused merely by a ring, it will stop immediately when the ring is taken out and no disturbance will be left after that. Therefore, a ring should be taken out immediately when atypical vaginal bleeding is seen. In light cases, it sometimes stops naturally by rest and styptics. Also reinsertion of rings after a while causes no more bleeding in some cases. The causes are entirely unknown.

**d. Pain**

The main pain after the insertion of rings is hypogastric pain and lumbago. The frequency is 13 of 623 cases (2.5%) in data A, 10 of 350 cases (2.8%) in data B, and 456 of 18,594 cases (2.2%) in data C. It is doubtful that hypogastric pain and lumbago are caused essentially by rings because these symptoms are most common in the gynecological field. It is also considered that a nervous woman feels uncomfortable to the insertion of ring, which can cause unpleasantness and abdominal pain psychologically. Pain is often caused when a ring is let down to the internal os or in the cervical canal. However, the symptoms are light in most cases and there are hardly any cases in which rings have to be taken out because of the pain.

**e. Inflammation**

Chronic endometritis by the stimulation of a foreign body and ascending inflammation by infection have been most feared by the insertion of a foreign body in the uterus. The clinical symptoms are fever, discharge, and pain. In my experiments, only three cases (0.4%) had to have the rings removed because of the increase in discharge. Fever was seen only in one case in which adnexitis sinistra was caused by the insertion of a ring after induced abortion. These three cases had endometritis and it proved that rings were inserted carelessly. It can be said that there is no need of worry about the inflammation by rings, because their materials and disinfection have been improved and antibiotics have been discovered.

**f. Period of time to occurrence of disturbances**

The interval between the insertion of the rings and the occurrence of disturbances is shown in Table 11. Most disturbances occur within 1~3 months. Therefore, if no abnormality is seen in 1~3 months after the insertion, it is fairly safe to think that no disturbance will occur in 1~2 years.

Table 11. Time when disturbance occur after insertion.

| | 1 month after | 2~6 m. after | 7~12 m. after | 1~2 year after | 2~3 y. after | 3~5 y. after | Total |
|---|---|---|---|---|---|---|---|
| A | 134<br>40.9% | 26<br>31.3 | 16<br>19.2 | 4<br>4.8 | 3<br>3.8 | 0<br>0 | 183<br>100.0 |
| B | 39<br>48.3 | 18<br>30.0 | 11<br>18.3 | 2<br>3.4 | 0<br>0 | 0<br>0 | 70<br>100.0 |

**g. Serious disturbances**

There was no serious side-effect in my experiments. MURAKAMI et al. reported on a case in which a ring was taken out surgically from the abdominal cavity. The ring had entered there perforating the uterus. Recently DÖRFFLER (1957) also found a ring in the abdominal cavity (Fig. 6). In these cases, probably the uteri were perforated by the insertion of rings and rings were introduced to the abdominal cavities through the holes. Especially, DÖRFFLER's case passed twenty years without any abnormality and conception was experienced twice during that period. The ring was found by chance on a X-ray picture. Therefore, such perforation is perhaps a disturbance provoked by induced abortion or an accident in the inserting operation rather than a disturbance of a ring itself. It is imprudent to attribute all of these to the side-effect of rings.

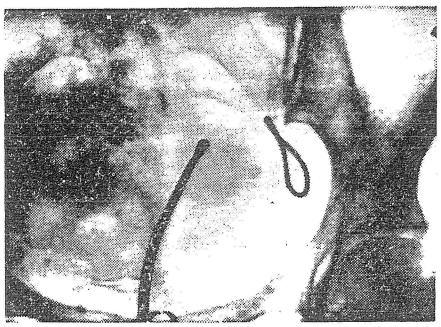

Fig. 6. Ring in the abdominal cavity (DÖRFFLER).

**3. Endometrium after the insertion of rings**

The endometrium of all the patients was examined histologically after the insertion of rings, as it was feared that the stimulation by rings might cause chronic inflammation on the endometrium. Some preparations are shown in Fig. 7, a, b. No particular

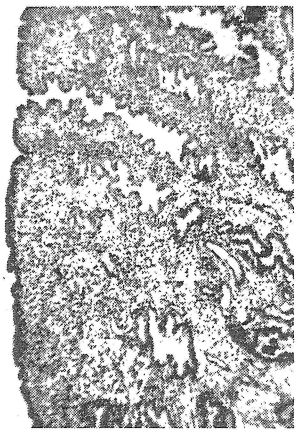

Fig. 7-a. T.S. 28 age. Endometrium in which ring was inserted for 12 months and removed it for exchange of ring (25 days after menstruation).

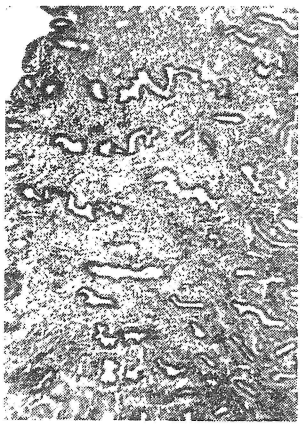

Fig. 7-b. S.M. 27 age. Endometrium in which ring was inserted for 6 months and take out it following hypermenorrhoe (20 days after menstruation).

change was seen on the tissue in either cases in which disturbance was seen or no disturbhnce was seen. A little bleeding was observed in the stroma, but no such findings of inflammation as enlargement of the glands, hyperplasy of gland cells, hyper-

trophy of stroma, edema and infiltration with round cells were seen. No serious necrosis was observed either in the parts where rings were placed. HASHIMOTO also reported that no particular pathologic change was observed on the endometrium in his investigation on 50 cases. Thus, I oppose to the opinion that the insertion of a ring always causes some inflammatory change on the endometrium.

### 4. Relations between rings and malignant neoplasms

It has been a matter of prime concern that the insertion of a foreign body in the uterus might cause a cancer. LOURE, BOWLESS and CARLETON stated that there was such danger if a ring was inserted for a long period. However, there has been no reported case which verifies this opinion. SHIMOMURA (1950) had a chance to operate carcinoma of the cervix of a patient, aged 46, who had a metallic ring for nine years. On his histological examination of the endometrium, he reported that only light hypertrophy and infiltration with round cells were observed on the part where the ring was placed and no direct relation between the ring and the squamous cell carcinoma on the cervix was certified.

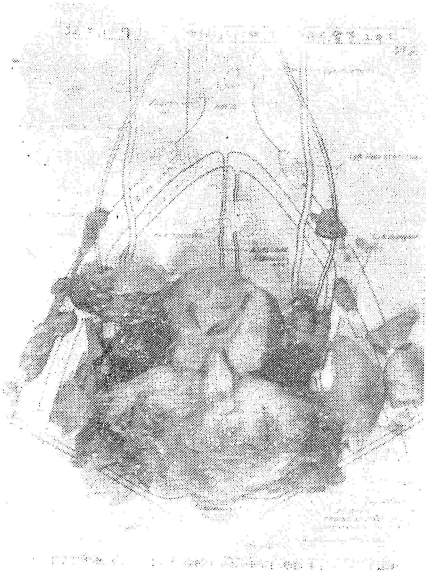

Fig. 8. Carcinoma of the uterus with ring.

Recently, I also experienced a case of carcinoma of the uterus which had a ring inserted. The patient was a 37 year-old woman who had eight deliveries and had a ring inserted in October, 1956. She had no abnormality until September, 1957 (one year since the insertion), when she came to the hospital complaining of the atypical vaginal bleeding. Carcinoma colli, II stage was diagnosed. Panhysterectomy was done on Oct. 7, 1957 (operator Prof. HATA) (Fig. 8).

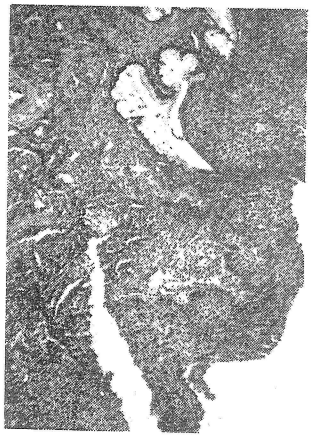

Fig. 9-a. Squamous cell carcinoma on portio vaginalis of the same uterus.

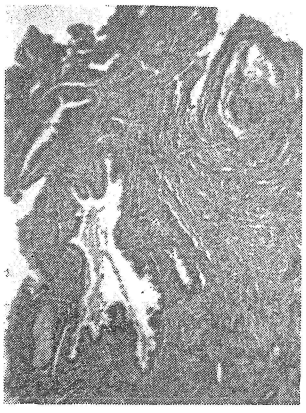

Fig. 9-b. The tissue on the cervical canal of the same uterus.

Serial sections from the portio vaginalis to the uterine cavity where the ring had been inserted were made. On the histological examination of the sections, the squamous cell carcinoma of the cervix disappeared about 1.3 cm from the external os, and did not pass over the internal os (Fig. 9a, b). Therefore, there was no relation between the ring inserted in the uterine cavity and the squamous cell carcinoma of the cervix. MIYAHARA also experienced a case of KURKENBERG's tumor which had a ring inserted (Fig. 10). In his case, too, no abnormality was found on the endometrium histologically, and this tumor was found after the operation of gastric cancer. As far as we have experienced and investigated, no malignant change of the uterus by the insertion of a ring was observed.

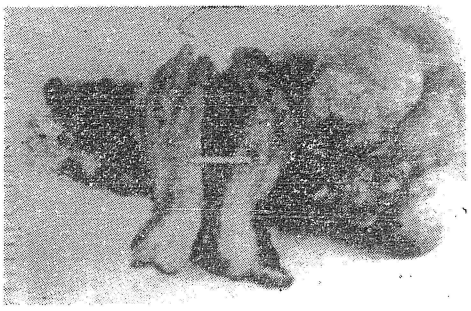

Fig. 10. KURKENBERG's tumor with a ring.

### 5. Shapes and materials of rings

More studies are needed on the shapes and materials of rings. Various rings, as shown in Fig. 11, have been made in Japan. Metallic rings are convenient for disinfection and X-ray examination, but cause more side-effects and have a possibility of intruding into the basal layer. Nylon and polyethylene rings which have been made recently seem to cause less side-effects.

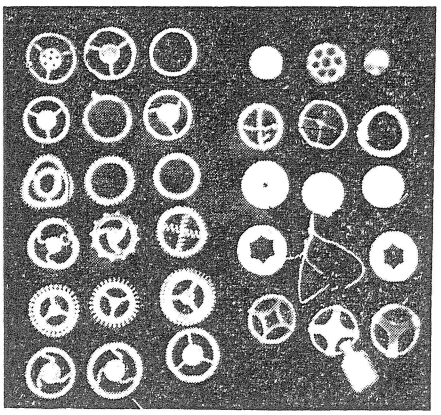

Fig. 11. Various rings used in Japan.

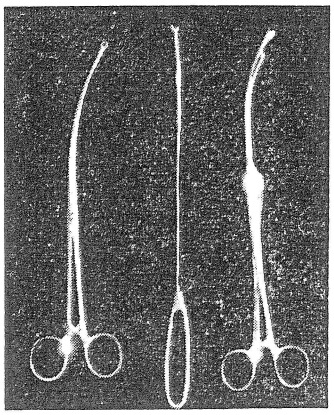

Fig. 12. Special forceps.

### 6. Insertion and removal of rings

Metallic rings should be sterilized by boiling. Nonmetallic rings should be left in mercurochrome, iodine-tincture and hyamine solution for 5~10 minutes. Such disinfection was enough bactericidal typhoid-, coli-, dysentery bacilli and staphylococci in our experiments. The cervical canal should be enlarged by HEGAR's dilatator 9~12 to insert a ring. Special forceps shown in Fig. 12 should be used in insertion. In the

removal, the cervical canal should be enlarged again, and the ring should be removed by the forceps for removal or KOCHER's forceps.

## SUMMARY

Investigations have been made on so-called "intrauterine rings" using my own experiences and data from the hospitals all over Japan. The effect is high and the serious disturbances are very few. Of course, as in any other method, it is impossible to expect 100% effect from it. Conception occurs even after tubal ligation which is supposed to be the most reliable way of contraception, and so it is only natural that the contraception by any other instrument or drug is more unreliable. A ring is, of course, a foreign body; therefore the living body naturally shows the disposing reaction against a foreign body. However, it is a matter of degrees. If the reaction is light, the living body will be adapted to it and shows no serious symptoms. If rings are opposed only because of their foreign bodies, opposition should also be made to the various foreign bodies used in the recent surgery and orthopedics. Even diaphragm pessary and tampon which are supposed to be entirely harmless can cause vaginitis when they are put for a long time. A serious case of diaphragm pessary is shown in Fig. 13.

Fig. 13. Serious case of diaphragm pessary.

Rings are still opposed by some scholars. The first reason of their opposition is that they are not contraceptives but to cause abortion. If it is true, decidual changes should always be seen and menstruation should always be delayed clinically. However, as stated above, no such changes are seen on the endometrium. Therefore, no spermatovum is implanted when the ring is showing its effect. Of course, conception can occur during the insertion of a ring. The ring seems to be inserted not in the right position in such case. The second reason of their opposition is that the insertion of rings cause carcinoma. The third reason is that they cause endometritis. My studies have clarified that there is no need of such worries.

Of course rings have various side-effects. They are varied depending on the time and technic of insertion and the kinds of rings. It is perhaps a problem left for the further study how to remove these side-effects.

## CONCLUSION

1. Investigations have been made on the effect of intrauterine ring, using 623 cases of metallic rings, 350 cases of polyethylene rings and 18,594 cases reported from the various hospitals in Japan.

2. Although there are still many problems left for the future studies, the contraceptive effect, calculated by STIX-NOTESTEIN's method, is 96.5%.

3. For the application of the ring, there should be no abnormality in the sex organs.

4. Post-menstruation period is recommended for the time of insertion. The periods before menstruation, after induced abortion and during puerperium should be avoided.

5. Labor and sexual intercouse should be prohibited for 5～10 days after the insertion. Examination should be done every half a year. It is recommended to exchange a ring with new one after a year.

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## REFERENCES

[1] ANDREW, C.: Migrating Graefenberg contraceptive ring. J. Am. Med. Assoc., **7**: 271～274, 1936.

[2] DOI, J.: Intrauterine ring. Japan. J. Fertility & Sterility, **1**: 6～11, 1956.

[3] DAIDO, J.: A case of intrauterine ring which had been inserted for 18 years. Sanfujinka no Shinpo, **6**: 5～6, 1954.

[4] FUKIDA, S.: Clinical experience of intrauterine ring. J. Japan. Obst. & Gynec. Soc. (Chugoku Shikoku Bukai), **3**: 25～25, 1953.

[5] FUJITA, T.: Conception during insertion of ring. J. Japan. Obst. & Gynec. Soc., **7**: 1216～1216, 1955.

[6] GRAEFENBERG, E.: Die intrauterine Methode der Kontrazeptionsverhütung. Kegan Paul, London, 1930.

[7] GRAEFENBERG, E.: Einfluss der intrauterinen Konzeptionsverhütung und die Uterusschleimhaut. Arch. Gynäk., **144**: 345～345, 1931.

[8] HAIRE, N.: A prelimary note on the intrauterine silver ring. International contraception symposium, 5～6, 1931.

[9] HOSAKA, T.: Effect and side-effects of intrauterine ring. Japan. Med. J., 1245: 141～144, 1948.

[10] HASHIMOTO, K.: Intrauterine contraceptive method. Clin. Gynec. & Obst., **6**: 664～667, 1952.

[11] HASHIMOTO, K.: Clinical experience of Ota intrauterine ring. Sanfujinka no Jissai, **1**: 395～398, 1951.

[12] HIROKAWA, I.: Clinical experience of intrauterine ring. J. Japan. Obst. & Gynec. Soc., **7**: 1955.

[13] ISHIHARA, T.: Effects of intrauterine ring and histological changes after its insertion. Sanfujinka no Shinpo, 4: 20～21, 1952.

[14] ISHIHAMA, A.: Clinical experiences of 600 cases of intrauterine ring. Sanfujinka no Jissai, 3: 616～619, 1954.

[15] ISHIHAMA, A.: Disturbances of intrauterine ring. Obst. & Gynec., 21: 714～717, 1954.

[16] ISHIHAMA, A.: Clinical experiences of temporary contraception by inserting ring. Iwate Med. J., 6: 47～49, 1954.

[17] ISHIHAMA, A.: The present state of contraception in Japan. Japan. Med. J., 1664: 34～36, 1956.

[18] ISHIHAMA, A.: Disturbances of intrauterine ring due to insertion in cervical canal. J. Japan Med. Assoc., 37: 364～366, 1957.

[19] ISHIHAMA, A.: Studies on intrauterine ring. J. Japan. Obst. & Gynec. Soc. (Tohoku Chihobu-kai), 1: 17～24, 1956.

[20] ISHIGURO, E.: Attention for insertion of ring. J. Japan. Obst. & Gynec. Soc., 7: 1666～1667, 1955.

[21] KLEIN, H.: Zur Frage der intrauterine Konzeptionsverhütung. Arch. Gynäk., 144 B: 345～345, 1931.

[22] KAWADA, S.: Contraceptive method for intrauterine cavity. Obst. & Gynec., 3: 1036～1038, 1935.

[23] KURIHARA, J.: Serious disturbance due to insertion of ring. Nichidai Igaku Zasshi, 7: 50～53, 1943.

[24] KIDO, Y.: Conception during insertion of ring. Obst. & Gynec., 16: 352～353, 1949.

[25] KONDO, K.: Experience of Ota rings. Sanfujinka no Shinpo, 4: 20～21, 1952.

[26] KAMIYAMA, M.: Case report of intrauterine ring. World Obst. & Gynec., 5: 470～471, 1953.

[27] KASEKI, T.: Clinical experience of intrauterine ring. J. Japan. Obst. & Gynec. Soc., 7: 1216～1216, 1955.

[28] KANASUGI, T.: 700 cases of intrauterine ring and histological examination of its endometrium. J. Japan. Obst. & Gynec. Soc., 8: 1058～1058, 1955.

[29] LEUNBACH, H.: The Graefenberg ring. The Practice of Contraception. 1931.

[30] LEUNBACH, H.: A new abortus provocatus method. The Practice of Contraception. 1931.

[31] LEUNBACH, H.: Erfahrungen mit Graefenbergschem intrauterinem Silberring. Arch. Gynäk., 144 B: 354～354, 1931.

[32] MURAKAMI, K.: On the contraception. Sanfujinka no Jissai, 2: 1133～1137, 1951.

[33] NAKASHIMA, K.: Conception during insertion of ring. J. Kyoto Pref. Med. Univ., 14: 153～155, 1943.

[34] MATSUMOTO, K.: On the case of myoma uteri which had a ring inserted. Obst. & Gynec., 16: 548～549, 1949.

[35] MATSUOKA, K.: Experience of ring which was inserted for long time. Hakuai, 5: 71～73, 1952.

[36] NOGI, A.: Effect of intrauterine ring. Sanfujinka no Shinpo, 3: 5～7, 1951.

[37] OTA, T.: A new method of temporary contraception. Kinki Fujinka Gakkai Zasshi, 18: 147～149, 1933.

[38] OTA, T.: Result of intrauterine ring. Sanfujinka no Shinpo, 3: 5～7, 1951.

[39] OTA, T.: Intrauterine ring. J. Japan. Obst. & Gynec. Soc. (Tokyo Chihobu Kaiho), 1: 5～6, 1952.

[40] OTA, T.: Prevention of ascending ring. J. Japan. Obst. & Gynec. Soc. (Tokyo Chihobu Kaiho), **2**: 7～7, 1953.

[41] OKUDAIRA, T.: One case of intrauterine ring which was inserted for 3 years. J. Japan. Obst. & Gynec. Soc. (Kumamoto Chihobu Kaiho), **4**: 53～54, 1952.

[42] PUST, D.: Ein brauchbarer Frauenschütz. Dtsch. med. Wschr, **29**: 952～956, 1923.

[43] OMORI, K.: Clinical experience of Ota nylon ring. Sanfujinka no Jissai, **4**: 590～591, 1955.

[44] STÖCKEL, W.: Die Konzeptionsverhütung als Gegenstand der klinischen Unterrichts. Zbl. Gynäk., **5**: 1450～1453, 1931.

[45] SAWASAKI, S.: On the contraceptive implement which is inserted intrauterine cavity. J. Japan. Obst. & Gynec. Soc., **32**: 1576～1578, 1937.

[46] SAWASAKI, S.: Presearing. Tokyo Med. J., 3033: 1144～1144, 1937.

[47] SHIMOMURA, T.: One case of carcinoma colli which had a ring inserted for 9 years. Sanfujinka no Shinpo, **2**: 12～15, 1949.

[48] SEKIGUCHI, K.: Disturbance about intrauterine ring. Nichidai Igaku Zasshi, **7**: 670～673, 1953.

[49] SANO, K.: Endometritis which was occurred by insertion of ring. Osaka Daigaku Igaku Zasshi, **15**: 152～156, 1956.

[50] TAGAMI, M.: Disturbance which was occurred by stimulation of intrauterine contraceptive implement. Sanfujinka no Shinpo, **2**: 184～184, 1949.

[51] TORII, S.: Application of metallic ring. Med. J. Kagoshima Univ., **2**: 228～231, 1956.

[52] TAKAHASHI, T.: One case of disturbance by intrauterine ring. Obst. & Gynec., **21**: 210～213, 1955.

[53] UCHIGAKI, S.: Biological study on the sterility. Kinki Fujinka Gakkaishi, **1**: 150～153, 1928.

[54] YOSHIDA, T.: 700 cases report of intrauterine ring. Obst. & Gynec., **24**: 525～528, 1957.

[55] YASAKI, K.: One case of intrauterine ring which was inserted for 20 years. Hokkaido Fujinka Zasshi, **1**: 100～104, 1950.

[56] YASUDA, Y.: Caesarean section due to intrauterine ring. Obst. & Gynec., **24**: 76～79, 1957.

[57] SUZUMURA, M.: A case of placenta praevia totalis with a contraceptive ring penetrated into its parenchym. World Obst. & Gynec., **9**: 1038～1040, 1957.

[58] FUJIMORI, H.: On the histological changes of uterus in which contraceptive ring remains inserted. World Obst. & Gynec., **9**: 629～631, 1957.

[59] NAWA, S.: Clinical observation upon contraceptive ring. World Obst. & Gynec., **9**: 1008～1011. 1957.

[60] GREEN, B.: Intrauterine foreign body and pregnancy. Am. J. Obst. & Gynec., **66**: 678～680, 1953.

[61] DÖRFFLER, P.: Über ein im Parametrium gelegenes Intrauterin-Pessar. Geburtsh. u. Frauenh., **17**: 743～747, 1957.