

THE TREATMENT OF UTERINE HEMORRHAGE BY THE RÖNTGEN RAY.*

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So much has been written of a controversial nature regarding the employment of this method in uterine bleeding that contributions from all quarters are welcome until all the indications and counter-indications can be reasonably determined. The present remarks are presented from the standpoint of the surgeon employing the Röntgen rays as an agent along with others and in general follow this argument: (1) The causes of uterine hemorrhage may be divided into two classes, (a) those peculiar to the uterus, being the causal factors of normal or pathological menstrual flow, (b) those common to all parts of the body regardless to sex. (2) Menstruation is dependent upon the presence of a corpus luteum. (3) The Röntgen rays destroy the follicle apparatus of the ovary and thus automatically cause menstruation to cease. (4) On the production of this artificial menopause depends the practical application of the Röntgen rays in the treatment of uterine hemorrhage.

Concerning the factors which cause the normal menstrual flow there are in general three theories: (1) that it is due to local cyclic changes and independent of the rest of the body, (2) that the changes in the endometrium occur under the influence of other organs in the body acting by means of chemicals carried through the circulation or (3) by means of nervous stimuli transmitted through the sympathetic system.

Since the publications of Meyer and others, there is no doubt that the cyclic changes in the endometrium follow closely and depend on the changes in the corpora lutea (15, 16, 6, 7, 8, 9, 17, 18, 19, 22, 23, 24). The time relationship between the two need not interest us here. That this action is chemical and due to substances acting through the circulation is shown by those cases of castration where autogenous transplantation of the ovaries has been followed by menstrual flow (14, 26, 27) and by the experiments of Fellner (3, 4) and

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Frank(31) who have produced in castrated animals by intravenous injection of extract of corpus luteum changes in the endometrium which simulate those of a normal premenstrual membrane.

The changes which in normal menstruation the endometrium undergoes are described by Hitschmann and Adler(12, 13), who give four characteristic pictures representing the postmenstrual, intermenstrual, premenstrual and menstrual types of endometrium. Microscopic sections of curetings of the normal endometrium vary so that a determination of the condition of an endometrium by microscopic examination cannot be made without the statement of the period in the menstrual cycle at which the curettage was done.

In abnormal menstruation, that is, bleeding from the uterus which does not contain a tumor or other gross lesion, the same three etiological factors are discussed. That the bleeding is not due primarily to changes in the endometrium is shown well by Hitschmann and Adler(13), who cite the similarity between the so-called hyperplastic or chronic endometritis and the premenstrual or early menstrual endometrium. They well point out that chronic endometritis is a pathological rarity and that the only conclusion which can safely be drawn from a study of such an endometrium is that it is the site of hemorrhage. Moreover, the great glandular proliferation of adenocarcinoma is rarely accompanied by any but a dribbling hemorrhage, while the greatly swollen membrane seen in congenital cervical stenosis characteristically hardly bleeds at all.

That the mechanical effects of arteriosclerosis and of fibrosis of the uterine muscle are more than contributory is made doubtful by comparing a series of nonbleeding and bleeding uteri from women of the same age when it is found that the incidence of fibrosis is about the same in each(28). Further, metrorrhagia is not a symptom of high arterial tension.

The positive proof of the activity of the corpus luteum in this type of bleeding is given in the injection experiments mentioned above.

Hemorrhage caused by factors common to all parts of the body, trauma, passive and active congestion, and ulceration is of interest from the standpoint of Röntgen ray therapy in hardly any condition save benign tumors (fibromyomata of the uterus). Passive congestion due to the pressure of the tumor on the submucous layer of veins will cease if the menopause occurs, while the bleeding from an ulcerated or pedunculated fibroid will often continue.

The action of the Röntgen rays is photochemical. The rays are similar to light, have a spectrum, induce secondary radiations in other bodies and act by being converted from one form of energy

into another, physical or chemical, just as sunlight striking a black surface becomes converted into heat and acting on certain silver salts converts them into silver oxide. This chemical action of the Röntgen ray depends on the absorption power of the element affected and follows very closely its atomic weight.

In living tissue this chemical action is peculiar in that the agent reaches its object without depending on the intervening structure for transportation as do soluble agents in the blood stream. For this reason it is understandable how the nucleus which contains the heavy elements of the cell can be effected without injury to the cytoplasm(11). Since the nucleus is the seat of life and reproduction of the cell(29), it is these properties which are effected by the Röntgen rays, while the cell permeability and secretive function(2) remain unchanged until the nucleus becomes altered. The change resulting from mild doses is increased mitosis and actual increase in number of cells, seen best when the lymphocytes are increased by the Röntgen ray. Large doses continue this nuclear division, until it becomes lawless and results in pyknosis and death of the cell.

The cells which are susceptible to the Röntgen rays are, in order, the lymphocytes in the blood stream, the ovum and follicle apparatus, bone marrow, spleen, parenchymatous glands, connective tissue and bacteria. The action on the ovary is rapid. Reifferscheid(21) saw pyknosis in the rat's ovary three hours after a moderate exposure and extensive degeneration twenty-four hours after a strong exposure. He showed that an injured ovum did not recover and that ovulation could not be resumed by regeneration but only through the maturing of primordial ova which had not been injured, since the ovum is a congenital cell and not the product of cell division like the spermatozoon. The more mature the follicle is, the more easily it is destroyed, the primordial follicle in young women being extremely resistant.

The effect of Röntgen rays on menstruation then depends on the number of follicles which have been destroyed. If nearly all of them are gone amenorrhea will be permanent, if only a few of the mature follicles are destroyed the amenorrhea will persist until the younger follicles develop. So then, by regulating the dosage we can produce an amenorrhea of almost any degree, failure being dependent only on our inability to estimate the dosage required. An occasional effect of a mild exposure seen in women with a continuous metrorrhagia is the appearance of several scant periods at more or less regular intervals and of short duration.

The clinical application of the above principles, which are so well

demonstrated as to amount almost to laws, is directed toward two conditions: (1) metrorrhagia in the grossly negative uterus and (2) fibromyomata.

In the first condition there are two types, (*a*) occurring in women near the menopause and (*b*) those below that age, particularly young girls at or shortly after the establishment of the menses. In the former a permanent amenorrhea is established unless there be a psychosis or other counterindication to the production of the menopause. The youngest arbitrary age at which this degree of treatment may be given is thirty-eight. The menopause differs but little from that which occurs normally, save that the onset of the symptoms is more rapid and the duration shorter. The results are as might be expected if the above principles be accepted, 100 per cent. amenorrhea.

The problem in the younger women is more difficult. Here a permanent menopause would be disastrous. With precise methods and modern apparatus, however, a temporary or partial amenorrhea may be induced by so graduating the dose as to destroy only the more mature follicles. There is but one objection to this procedure, namely, the possibility that an ovum only slightly injured by the Röntgen rays might subsequently become impregnated and owing to this injury develop into a defective individual. Since Reifferscheid has shown that an injured ovum does not recover, since there have been several cases reported in which the resulting child has not been defective, and since experiments on animals have shown that offspring from exposed animals are not inferior to those of the controls, I believe that the procedure in careful hands may be safely carried out. Because of the objection mentioned, I have only recently treated such cases, one in a woman of thirty-four (a bleeder) and one in a woman of thirty-five who refused hysterectomy for fibroid. The first had an amenorrhea of three months followed by scant periods up to the present, the second had scant regular periods for six months and began to flow profusely when treatment was resumed with result.

The production of the menopause where benign tumors exist offers little difficulty unless they are ulcerating or pedunculated, when the hemorrhage not being dependent on the menstrual excitant may persist after menstruation has ceased.

It is for this reason that "cures" of fibromomata have been only 85 per cent. as against 100 per cent. in the simple metrorrhagia, a cure indicating the establishment of amenorrhea or oligomenorrhea with the shrinkage of the mass to insignificant proportions. This

shrinkage is due to the same causes which obtain in normal menopause, as well as to the direct action of the rays upon the pathological tissue. For my part, I have attempted by filtration and the production of a highly penetrating ray to confine as far as possible the action to the ovaries, believing that the myomatous tissue is so similar to normal smooth muscle that what would injure the first would injure the latter and that an agent causing obliteration of uterine vessels will do the same to the vessels of other structures. However, it is true that the myoma shrinks much more rapidly in the artificial than in the normal menopause. In Mrs. F. a mass averaging 20 centimeters in diameter shrank to 8 or 10 centimeters in six months.

The application of the Röntgen rays in these cases then may be safely expected to produce a cure. The next point to be decided is the selection of the case. In general, fibromyomata which do not constitute an immediate or remote menace to the individual and occur in women over thirty-eight years of age are suitable cases. The conditions which constitute an immediate menace are inflammation or necrosis in the tumor, the presence of sarcoma and the coincident occurrence of dangerous diseases of the adnexa. Sarcoma of the uterus occurs twice in 350 cases of fibroid tumor in the pathological records of the Presbyterian Hospital, New York. Raab (20) found that many of the so-called myosarcomata were in reality nonmalignant. On the other hand, cases of sarcoma discovered after Röntgen ray treatment have been reported (28). Inflammation and necrosis in the tumor offer less difficulty and can be made out by careful diagnostic methods. The presence of new-growths in the ovary prohibits Röntgen ray treatment. Inflammation in the adnexa may or may not constitute a counterindication even if tuberculous because of the well-known effect of sunlight and almost as well-proved effect of artificial rays (Röntgen and ultraviolet rays) on this process. If definite tender inflammatory masses exist, I prefer to excise fibroid and tubes. If there appear to be adhesions which make operative injury to the hollow viscera likely, I prefer to use the artificial menopause. Again the mechanical dangers of a large fibroid occasionally contraindicate radiotherapy, as does a large mass which presses on the bladder and intestines and will require several months in which to greatly diminish in size.

What percentage these contraindications constitute varies with the individual observers from 16 per cent. to 95 per cent. Personally, 40 per cent. of the cases have been operated upon and 60 per cent. treated by Röntgen rays with no bad results. An isolated instance of some importance should be mentioned here.

A woman of thirty-eight appeared with a history of eight months increasing menorrhagia and of late metrorrhagia. Examination revealed uterus slightly above normal size and slightly irregular in contour. Bleeding controlled by pituitrin and ergot. Patient appeared about six months later with history of normal periods for three months and increasing metrorrhagia for three months. Examination showed uterus about 12 centimeters in diameter, soft, tender, temperature 100, some prostration. Diagnosis of rapidly growing fibromyoma with inflammation or necrosis. Laparotomy. Uterus had typical appearance of pregnancy. That night a severe uterine hemorrhage. Curettage performed and about 10 c.c. of soft curetings obtained. (Pathological report, pregnancy.) Ten days later severe hemorrhage began. On assurance that curettage had been most thorough, radiotherapy was begun with uterus slightly larger than normal. Amenorrhea after two months, uterus about average size, menopause symptoms slight.

This was clearly a case of pregnancy in a woman suffering from ovarian metrorrhagia and is cited to demonstrate the care necessary in handling these cases and also to show that uncalled-for laparotomies or even hysterectomy are performed on mistaken diagnosis and that our inability to make such a diagnosis should not preclude the use of this other valuable agent in fibromyomata of the uterus, but that rather we should improve our methods of diagnosis.

In women under thirty-eight unless otherwise contraindicated, myomectomy or hysterectomy is performed because, unless amenorrhea be permanent, the tumor most often resumes its growth with the reappearance of the menses.

The Röntgen ray treatment of operable carcinoma is contraindicated.

The technic followed has been to divide the abdomen below the umbilicus into nine areas, using the back and each buttock for three more, making a total of twelve. Through each of these in turn the rays are directed at the point where the nearest ovary is supposed to be. The size of the abdominal areas being from 5 to 6 centimeters square will allow for some error in calculation so that most of the rays reach the ovary. The measurements of the dosage are: Distance from anode to skin 25 centimeters, spark gap 22 to 24 centimeters, milliamperes 7, Bauer 10, filter 3 millimeters glass, 1 centimeter of wood, 3 millimeters of aluminum. This gives 1 Holzknacht unit a minute. Seven Holzknacht units are given to each skin area. The series is repeated after three weeks.

The personal results have been as follows in twenty women of thirty-eight and over whether possessing fibroids or not, complete amenor-

rhea in 5 per cent. from the onset, in 5 per cent. after one period, in 5 per cent. after three periods and in 85 per cent. after two periods. The first period occasionally is profuse. All of the cases have been severe enough to partially or completely incapacitate the women. Activities were resumed usually about three weeks after the first exposure.

I have only attempted this treatment in younger women twice, for the reasons mentioned above; these have been recent and have presented no difficulties. Amenorrhea for three months followed by scant flow for two periods in one case and an oligomenorrhea of six months followed by a profuse flow which responds to treatment in the second, have been the results obtained.

Severe untoward effects have occurred in only two cases. One suffered from nausea and diarrhea, the other from diarrhea indistinguishable from mucous colitis. Many of the women felt fatigued for a day or two and a few suffered headaches; albumin and casts appeared in the urine of one woman. No late effects other than those accompanying the menopause have been noted save in one case where there was an attack of uremia six months after the end of treatment in a woman suffering from large polycystic kidneys. The skin becomes tanned after two series, fading after cessation of the treatment. No dermatitis has resulted from the dosage. A small linear burn occurred in the very first case treated because of imperfect apposition of the lead protection. Slight vesication resulted but the skin became normal again in six weeks. This accident has not recurred.

CONCLUSIONS.

- I. The causes of uterine hemorrhage may be divided into two classes:
 - (1) Those peculiar to the uterus and causing normal or pathological menstruation.
 - (2) Those common to all parts of the body regardless of sex.
- II. Menstruation is dependent on the activities of the corpus luteum.
- III. Röntgen rays destroy the follicle apparatus of the ovary and thereby automatically bring about a menopause.
- IV. In bleeding from the uterus without gross pathological lesion whether accompanied by changes in endometrium or fibrosis of arteries or myometrium, production of the menopause constitutes a cure.
 - (1) In women over thirty-seven this menopause is made complete.

(2) In women under that age the menopause is incomplete either with a temporary amenorrhea or merely a lessening of the flow.

- V. All myomata which do not constitute an immediate or remote menace aside from that of hemorrhage are proper subjects for the production of the menopause provided that ulcerative changes or pedunculated fibroids or polyps do not exist and provided that the possessor be over thirty-seven years of age.
- VI. All myomata which constitute a menace in women under thirty-eight should be excised rather than be subjected to Röntgen rays unless operation is contraindicated.
- VII. In hemorrhage from malignant disease Röntgen rays are contra-indicated.

REFERENCES.

1. Albers-Schoenberg. *Fortschr für Roentgen Str.*, 1913, xx, 93.
2. Bering. *Strahlentherapie*, 1913, Vol. No. iv, 784.
3. Fellner. *Arch. f. Gynäk.*, 1913, c, 641.
4. Fellner. *Centralbl. f. Gynäk.*, 1912, xxiii, 673.
5. Findley. *Tr. Am. Gynec. Assn.*, 1912, xxxvii, 82.
6. Fraenkel. *Arch. f. Gynäk.*, 1910, xci, 705.
7. Fraenkel. *Centralbl. f. Gynäk.*, 1911, xxxv, 1591.
8. Frank. *Surg., Gynec. and Obst.*, 1911, xiii, 36.
9. Frank. *Ibid.*, 1914, xix, 618.
10. Heineke. *Mitt. a.d. Grenzgeb. d. M. u. Ch.*, 1904, xiv, 21.
11. Hertwig. *Arch. f. Mikr. Anat.*, 1912, lxxix, 201.
12. Hitschmann and Adler. *Arch. f. Gynäk.*, 1913, c, 233.
13. Hitschmann and Adler. *Monatsschr. f. Geburts. u. Gynäk.*, 1908, xxvii, 1.
14. Lydston. *N. Y. Med. Journ.*, 1914, c, 745.
15. Meyer. *Arch. f. Gynäk.*, 1911, xciii, 354.
16. Meyer. *Ibid.*, 1913, cx, 1.
17. Miller. *Arch. f. Gynäk.*, 1913, ci, 543.
18. Novak. *Jour. A. M. A.*, 1914, lxiii, 617.
19. Novak. *Surg., Gynec. and Obst.*, 1915, xxi, 336.
20. Raab. *Arch. f. Gynäk.*, 1913, c, 389.
21. Reifferscheid. *Strahlentherapie*, 1914, v, 407.
22. deRouville. *Rev. mens. de Gynec. d'Obst. et de Pediat.*, 1914, ix, 161.
23. Ruge. *Arch. f. Gynäk.*, 1913, c, 20.
24. Schroeder. *Arch. f. Gynäk.*, 1913, ci, 1.
25. Shoemaker. *Jour. A. M. A.*, 1915, lxiv, 1653.
26. Storer. *Bost. Med. Surg. Jour.*, 1915, clxxii.
27. Tuffier, Gerry, Vignes. *Bull. Mem. Soc. Anat.*, 1913, lxxxviii, 193.
28. Schwartz. *Med. Record*, 1914, lxxxvi, 155.
29. Adami. *Text-book of Pathology*.
30. Richards.
31. Frank. *Surg., Gynec. and Obst.*, 1915, xxi, 646.

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