IRRADIATORS FOR TREATING THE BODY

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ABSTRACT
This application discloses apparatus and a technique for the treatment of cancer of the fundus of the uterus and of other portions of the human body. A capsule is provided which comprises a thin-walled narrow tube, on the lead end of which may or may not be provided an elongated and enlarged bulbous body portion. The inner diameter of the lead end of the tube is sufficient to accommodate a source of radioactive material. The tube is arranged so as to permit the insertion of a radioactive source into the lead end of the tube through the trailing portion thereof. The outside diameter of the tube is no greater than 2 mm. so as to permit the tube to be retained within and tolerated by a portion of the human body into which the tube is to be inserted. Furthermore, due to the aforementioned small diameter of the tube, the portion of the human body may be packed with a number of such capsules. Due to the small internal diameter of the tube, a radioactive source whose specific activity is higher than that of radium is implanted in the tube by being introduced through the trailing end thereof.

25 Claims, 24 Drawing Figures
IRRADIATORS FOR TREATING THE BODY

This application is a continuation-in-part of my co-pending application, Ser. No. 587,335, filed Oct. 17, 1966 and now abandoned.

This invention relates to the treatment of cancer of the fundus of the uterus and of other portions of the human body. It relates in particular to apparatus and procedure for packing the uterus or other portions of the human body with devices for the treatment of cancer.

In the past, the most popular and effective technique for the radiation treatment of cancer of the uterine cavity has been the use of "Heyman" apparatuses. These are metal cylinders about 8 mm. in diameter and 2 cm. long containing 5 to 10 milligrams of radium in each. The applicator (or irradiator) has a long wire attached to it, and a special introducing apparatus is used to place the applicator into the uterine cavity, leaving the long wire to lie in the vagina. As many of these irradiators as possible are packed into the uterine cavity, usually 6 to 10 of such Heyman capsules. Such method of treatment of adenocarcinoma of the uterine cavity has been used as the sole form of treatment or as pre-operative radiation for adenocarcinoma of the fundus of the uterus.

In ordinary use, a patient, whose diagnosis of cancer of the uterus has been established by previous dilatation and curettage, is once again anesthetized, and the capsules are inserted one at a time into the uterus through the dilated cervix. Technical difficulties may slow the procedure even in experienced hands, and the radiation exposure to the operators may be high, usually 50 to 100 milliRoentgens (100 mR is the Federal Radiation guide for one week's exposure).

Some of the disadvantages of the Heyman capsules are attributable to the use of radium which has a relatively low specific activity and a relatively high energy. There is also the danger of leakage of radon gas. The low specific activity requires larger size sources to obtain the activity in the area desired. The higher energetic gamma radiation on the other hand makes it difficult to shield for protection. Moreover, its long half-life frequently presents a decontamination problem. Since each capsule contains radium of considerable intensity, there is a quite natural tendency on the part of the operator to work rapidly in order to minimize exposure to himself and to other operating room personnel. Such conditions tend to make for compromises with the ideal therapeutic treatment.

Similar disadvantages were found upon treatment of cancer in portions of the human body other than the uterus, such as the cervix, unresectable masses in the pelvis, abdomen, chest, head, neck, breasts, and other places.

Objects of the present invention, therefore, include the provision of apparatus and methods by the use of which exposure of operating room personnel is reduced appreciably.

Another object is to provide such methods and apparatus by the use of which the operator can insert and implant devices within the body without at the same time being exposed to radiation, and under conditions such that he can employ the usual precision of the surgeon.

Still another object of the invention is to avoid the second operation which has heretofore been necessary to implant the irradiators after diagnosis.

Yet another object of this invention is to provide a method and apparatus which use the after loading technique and are adaptable for radiating cancerous cells in or adjacent to any portion of the human body.

A further object of this invention is to provide such an after loading apparatus that is significantly smaller than any known in the prior art.

Still a further object of this invention is to provide a novel method of inserting the after loading apparatus into certain portions of the human body where cancerous cells are located.

Yet a further object of the invention is to provide means for radiation treatment of the uterus without the disadvantages attended with the use of radium.

In accordance with the present invention, a capsule is provided which is adapted to be inserted into the uterus through the cervical os and retained by the uterus. Such capsule has an elongated and an enlarged bulboous body portion with a cavity therein, the cavity being disposed generally longitudinally within the body. The diameter of the cavity is sufficient to accommodate a source of radioactive material therein. Connected with the body and in communication with the cavity there is a thinwalled narrow tube which is arranged coaxially with the cavity so as to permit the insertion of a radioactive source into the cavity through the tube. Preferably, the capsule and tube are so formed that an array of similar devices may be implanted in the uterus. An important feature of the invention, as will appear hereinafter, is the outside diameter of the tube, which is not greater than about 2 mm. In this way a number of such capsules and tubes can be retained within and tolerated by the uterus with said tubes projecting through the cervical os. The radioactive sources then may be inserted into the respective cavities of an array of said capsules after the capsules are positioned in the uterus.

Also in accordance with the invention a capsule comprising a thin-walled narrow tube, with or without an elongated and enlarged bulboous body portion attached to the lead end, is provided which is adapted to be inserted in and retained by any portion of the human body. The invention is also adaptable to be used adjacent to diseased portions of the surface of the human body. The outside diameter of the tube is preferably no greater than 2 mm. in diameter. A trailing portion of the tube projects outwardly through the portion of the human body in which the tube is inserted so that a source of radioactive material may be after loaded into the tube, that is, inserted into the tube after it has been placed in proper position. As in the previously described adaptation for use in the uterus, an array of capsules is preferably implanted and retained in the human body portion. In one embodiment of the invention an elongated stiffening member is provided in the tube during insertion into the human body portion. After the tube has been implanted the elongated stiffening member is withdrawn and replaced by a pre-formed elongated member in which is located a radioactive source.

Extremely important to this invention is the fact that the outside diameter of the thin-walled tube is preferably no greater than 2 mm. Because of the small diameter the tubes can easily be inserted and retained by any
portion of the human body. Such miniaturization was technically impossible until just recently with the development of radioactive isotopes with a specific activity higher than that of radium. Now very minute portions of radioactive isotopes such as iridium-192, cesium-137 and cobalt-60 emit sufficient radiation for the treatment of tumors.

The invention may be readily understood by reference to the appended drawings, in which

FIG. 1 shows a capsule including its appended tube;
FIG. 1a is a longitudinal sectional view of a capsule of FIG. 1 with the intermediate portion of the tube broken away shown on an enlarged scale;
FIG. 2 illustrates another tube constructed in accordance with the invention;
FIG. 2a is a longitudinal sectional view of a capsule of FIG. 2 with the intermediate portion of the tube broken away shown on an enlarged scale;
FIG. 3 is a sectional view through the uterus and vagina showing the implantation of one of the capsules;
FIG. 4 is a view similar to FIG. 3 but showing the implantation of a number of the capsules;
FIG. 5 shows the capsules after the insertion of the radioactive sources;
FIG. 6 shows the type of capsule illustrated in FIG. 2 implanted in the uterus, also including the radioactive sources.

FIG. 7 is a perspective view of a thin-walled tube without the bulbous body portion;
FIG. 8 shows a tube in which an elongated stiffening member has been inserted;
FIG. 9 is a perspective view of a preformed elongated member including a charge of radioactive isotope in one end thereof;
FIG. 10 shows the special adaptation of the tubes for treatment of cancer of the cervix of the uterus, the tubes containing elongated needle members and being used in conjunction with Manchester ovoids;
FIG. 11 is similar to FIG. 10 with the elongated stiffening members being replaced by the preformed elongated members containing charges of radioactive isotopes;
FIG. 12 shows the position of one tube for treatment of a tumor remote from the surface of the body;
FIG. 13 shows an array of tubes containing elongated stiffening members for treatment of a tumor remote from the surface of the body;
FIG. 14 is similar to FIG. 13, however the elongated needle members have been replaced by elongated members containing radioactive charges;
FIG. 15 shows an adaptation of the tubes for treatment of a tumor near the surface of the body;
FIG. 16 is a perspective view of the expanded portion of the trailing end of a tube, the expanded portion containing a hole through which a suture can be passed for connecting the tube to the outer surface of the human body;
FIG. 17 is similar to FIG. 16, however the expanded trailing end of the tube includes an annular groove instead of a hole for connecting by suturing the tube to the outer surface of the human body;
FIG. 18 shows a tube with a needle inserted therein, an end of which projects through the lead end of the tube for puncturing the skin of the human body and inserting the tube within a human body portion;
FIG. 18a shows a tube with a closed sharpened end for puncturing the body;
FIG. 19 shows the tube being contained within a needle for insertion of the tube into a human body portion;
FIG. 20 shows the positioning of a tube for treatment of cancer on the surface of the human body; and
FIG. 21 shows an array of tubes for treating cancer on the surface of the human body.

Referring then to FIGS. 1 and 1a, the bulbous body portion, suitably constructed of plastic material (such as nylon), is indicated at 10 and has a cavity 11 therein. It is preferably about 6 mm. in diameter and 2 cm. in length, although larger or smaller dimensions, for example, up to about 10 mm. diameter, may be used. It will be noted that, as previously indicated, the cavity 11 is elongated in the axial direction of the bulbous portion 10.

Inserted within the cavity 11, there is a thin-walled tube 12 which also may be made of suitable plastic material (such as nylon). As previously suggested, and as explained more fully below, the outside diameter of the tube 12 is of considerable significance. The remote end 15 of the tube 12 is flared to facilitate the insertion therein or the radiation source as subsequently described.

Referring now to FIGS. 2 and 2a, the bulbous body portion 20 is found to have a longer axial dimension, (for example, 4 to 5 cm.) and may be somewhat smaller in diameter (e.g., 3 mm.) than the bulbous portion 10 of the device shown in FIG. 1. It is also provided with a connecting tube 22 which has a flared end 25 to facilitate the insertion of the radioactive source. A feature of the bulbous end 20 of the FIG. 2a device is that it is made of a plastic material which has a "memory" so that it will tend to retain a certain predetermined shape after being deformed. The importance of this feature will be explained more fully below. Otherwise, the capsule and tube of FIG. 2 are the same as that of FIG. 1.

The manner of inserting the devices of the invention will now be described. Under general anesthesia, the cervix is exposed (as indicated in FIG. 3, but without showing the apparatus used) and is grasped with tenaculum. The area affected by cancer is indicated by the shaded area 28. The cervix is dilated in a known manner and the uterine cavity is sounded to ascertain its shape and approximate volume. The first of the capsules is then inserted, as indicated in FIG. 3, the bulbous end first by holding its thin tail and pushing the bulbous end as far as possible into the depths of the uterine cavity as shown in FIG. 3. Thereafter, the physician continues to insert as many capsules as the cavity will hold by pushing the bulbous end of each as high as possible into the cavity (as shown in FIG. 4). The semi-rigidity of the "tail" or tube 12 will prevent excessive pressure which otherwise could perforate the uterus. After the uterus has been packed with empty capsules, anesthesia may be stopped.

Radioactive material 30 is mounted in the end of a thinner plastic tube 31. Prior to use, it is stored in suitable lead shielded receptacles ready for rapid loading into the pre-placed capsules. At the time of irradiation treatment, the radioactive source are rapidly inserted into the flared ends 15 of the tubes 12. After a suitable time interval for irradiation treatment, the radioactive material is removed from the capsules and tubes may be discarded or sterilized for re-use.

The elongated or "hockey stick" capsules illustrated in FIGS. 2 and 2a may be loaded and charged in a similar manner as illustrated in FIG. 6. It will be observed
that after being pushed in the uterus, they assume the shape determined by their elastic memory so as to con-sume with the contours of uterus walls. It is also signifi-cant that, due to the greater length of the hockey stick-shaped capsules, the radioactive sources may be ar ranged in an array within the uterus to provide the de-sired location and intensity of irradiation. This is indi-cated by the location of the radioactive source material within the capsules as shown by reference No. 40 in FIG. 6.

As previously indicated, one of the principal features of the invention is the small outside diameter of tubes 12 and 22. The importance of this feature will now be appreciated since in order to pack the uterus with the desired number of capsules, it will be necessary to have a separate connecting tube for each such capsule within the uterus. The uterine os, however, will tolerate only a certain maximum total cross-sectional area of tubes, so as if the tube diameter is too great it will not be possible to use this type of therapy. I have found that a maximum outside diameter of 2 mm. per tube is con-sistent with the desired uterine packing without en-countering the problem of too great a cross-sectional area of tubes passing through the uterine os. Preferably, the outside diameter of the tubes 12 and 22 is about 1.6 mm. and its inner diameter is about 1 mm.

Now, referring to FIGS. 7 and 8, the capsule in which the radioactive charge is to be inserted is a thin-walled tube 50 that preferably does not include a bulbous por-tion around its lead end 52. Tube 50 is adaptable for treatment of cancerous tissue in any portion of the human body, and is especially suitable for such use when the outside diameter of tube 50 is no greater than 2 mm. The small size is important for facility of inser-tion and implantation of the tube and for the elimina-tion of an additional operation procedure. Until just re-cently this miniaturization was technically not feasible because of the relatively low specific activity of the known radioactive isotopes and the relatively large amounts that had to be used. However, very small amounts of isotopes with a higher specific activity, as will be described below, are now sufficient for use with the after loading device that is the subject of this inven-tion.

Tube 50 preferably includes at its trailing end an ex-panded bell-shaped portion 54 to promote quick and accurate insertion of elements into tube 50, whereby undue radioactive exposure during the loading step is prevented. Tube 50 is preferably formed of a flexible plastic material and, as illustrated in FIG. 8, an elon-gated stiffening element 56, which can be an 18 guage needle, is contained in tube 50. Stiffening element 56 prevents tube 50 from excessive bending or distorting during the implantation process and is formed of a ra-dioactive inert material. After tube 50 containing stiff-en-ing element 56 is implanted, X-rays may be taken to determine whether tube 50 has been placed in its proper treatment position. If so, stiffening element 56 is withdrawn by grasping and pulling gripping portion 58.

The after loading process is completed by inserting through tube 50 a preformed sealed elongated element 60 which contains a charge of radioactive isotope as indi-cated by shaded portion 62, best illustrated in FIG. 9. Element 60 includes a gripping end 66 one portion of which is smooth and flat on which can be etched or printed information concerning the isotope, the date the element was charged, and the specific activity of the isotope.

One example of the wide variety of uses to which tube 50 may be put is illustrated in FIGS. 10 and 11 which show an adaptation of three such tubes for treat-ment of cancerous portions, generally designated by numeral 68, of the cervix 70. Tube 50a is inserted through the cervix 70 and into the uterine cavity 72. A collar 74 preferably formed of a plastic material is ad-justably positioned along the length of tube 50a to pre-vent it from puncturing the back wall of the uterus 72. The small size of tube 50a permits the insertion of the single tube without anesthesia having been adminis-tered to the patient and eliminates the need for per-forming the process in an elaborate operating room.

Tubes 50b are held in place in the vagina 76 by means of ovoidal elements 78, such as standard Man-chester ovoids in which holes have been drilled to re-ceive the the lead ends of tube 50b. The ovoidal ele-ments 78 can be manually grasped and inserted, a fea-ture heretofore considered foolishly and dangerous because a radioactive charge had to have been placed in the ovoidal elements 78 before their insertion. As de-scribed above stiffening elements 56 are contained in each tube 50.

After X-rays confirm the proper location of the tubes 50 in relation to the cancerous area 68, the stiffening elements 56 are removed and replaced by preformed elongated members 60, each containing a charge of ra-dioactive isotope 62 as best illustrated in FIG. 11.

In FIGS. 12 to 14 the adaptation of a tube 50 is illus-trated for treatment of a tumor 79 located deep within the human body. A tumor of this type could be unresectable and lying in the retroperitoneal region which is near the pancreas, behind the lining of the abdominal cavity and directly in front of the spine. A surgical wound 80 is inflicted on the patient and extends to the tumor 79 which is "notched" at strategic points where tubes 50 are to enter the tumor 79. A tube 50 contain-ing a stiffening member 56 is inserted through wound 80 to a "notch" and then pushed into the tumor a dis-tance considered best by the treating physician. FIG. 13 illustrates an array of tubes 50 implanted in such a tumor.

The tubes 50 need not be implanted in the tumor 79 itself, but may be placed in or around the tumor within what is called the "target volume," that is, the general area considered by the physician to be best and most effective for treatment of the cancerous portion. FIG. 14 is similar to FIG. 13, however a charge of radioac-tive isotope 62 has been inserted in a portion of each tube 50 in or near tumor 79.

FIG. 15 illustrates a further adaptation of tubes 50 for treatment of a tumor 82 in a portion of the body near its surface, or what may be described as a rela-tively superficial tumor such as one in the female breast 84. In this case the tumor 82 is normally 1 to 4 cm. deep, thereby a tube of about 2 to 5 cm. long would be used for treatment. Because of the relatively short length of the tubes and of the various angles at which the tubes may be implanted, it may be desirable to at-tach the tubes 50 to the skin of the breast to prevent them from falling out during treatment. As illustrated in FIGS. 16 and 17, respectively, a hole 86 or an an-nular groove 88 may be formed in the expanded bell-shaped portion 54 through which a suture may be passed and attached to the skin.
The implantation procedure is similar to those described above, except for the preferable technique used for insertion of tubes 50. A surgical wound may be utilized, however, a simpler and quicker procedure may be desirable such as that now used in the insertion of catheters into blood vessels of the human body. FIG. 18 illustrates the use of a standard 18 gauge syringe needle in conjunction with a tube 50. The needle 90 whose outside diameter is about 1 mm. is inserted through tube 50 and projects outwardly from its lead end 52. The needle 90 is then used to puncture the portion of the body to be treated, with needle 90 and tube 50 being pushed in or near the cancerous portion. Needle 90 is then withdrawn and replaced by a prefomed member 60 containing a radioactive charge 62 as described above. For puncturing and inserting a tube 50 into certain portions of the human body, lead end 52 need not be open but can be closed, as illustrated in FIG. 18a, and provided with a relatively sharp end. Either a stiffening element 56 or a needle 90 can be contained within tube 50 during insertion. FIG. 19 illustrates a variation of the insertion technique wherein tube 50 is contained within needle 90, which in this case is preferably a 14 gauge needle whose outside diameter is about 2.5 mm. In this latter variation tube 50 would necessarily have to be formed without an expanded bell-shaped portion at its trailing end.

A still further adaptation of tube 50 for treating cancerous portions of the body is illustrated in FIGS. 20 and 21. Here, instead of being inserted into the body, tube 50 is laid adjacent a surface tumor 92. As in treatment of tumors in other locations an array of tubes 50 is laid on the tumor and secured thereto by means of bandages or the like. Then, preformed members 60 containing radioactive charges 62 are inserted into each of the tubes 50. Obviously, tubes 50 may be used for treating cancer in many other portions of the human body and may be adaptable for use with other specially designed elements.

Within the restrictions of the internal diameter of such a small tube, it is not possible to use radium as a radioactive source. This is due to the lower specific activity of radium which requires that sources having larger physical dimensions be used. Accordingly, in accordance with the present invention I employ other radioactive material whose specific activity is higher than that of radium. Preferably, iridium-192, a radioactive isotope, is used. This may be mounted at the tip of a thin nylon tube (slightly less than the internal diameter of the tubes 12 and 22). The activity of Ir-192 is such that a sufficiently active source may be mounted in such a thin tube. Iridium-192 has the advantage of a high specific activity so that the equivalent of 5 mgm. of radium can be supplied in a tiny rod 0.3 mm. in diameter and 15 mm. in length. Its particular gamma radiation makes it suitable as a radium substitute, and its lesser energy makes it easier to shield. Its half-life of 75 days is long enough to keep Ir-192 clinically useful over a practical period of time and short enough to reduce its hazard in comparison with radium.

Another suitable type of radiation source is cobalt-60 or cesium-137. With each of such radiation sources, a charge having sufficient activity can be mounted in a thin tube which is small enough to avoid rejection by the uterus or discomfort to the patient, which would be caused by larger tubes.

When the operator inserts the radioactive source into the blank tubes, he may do so with the usual precision of the surgeon and without haste which might be caused by working under conditions of harmful radiation. Correction and repeated checks of the position of the tubes are feasible as by X-ray.

Tubes of appropriate size can always be available for use in the operating room. As a result, patients with suspected adenocarcinoma can be spared an extra operating procedure. That is, for treatment of the uterus it may be packed at the time of dilatation and curettage. The following day if the biopsy proves cancer to be present, radioactive material can be inserted through the tubes into the capsules. This insertion is done simply in the patient's room with minimum assistance and personnel, rapidly without exposure and painlessly without anesthesia. The elimination of an extra operative procedure in the treatment of adenocarcinoma of the uterus is often very important, for these patients as a group tend to be elderly and may have associated diseases which make their operation technically hazardous.

1 claim:

1. A capsule adapted to be inserted in and retained by the uterus, comprising an elongated and enlarged bulbous body portion with a cavity therein, said cavity being disposed generally longitudinally within said body portion and having a diameter sufficient to accommodate a source of radioactive material therein, a thin-walled narrow tube connected to said body portion and arranged coaxially with said cavity so as to permit insertion of a radioactive source into said cavity through said tube, the outside diameter of said tube being not greater than 2 mm. so as to permit said capsule to be retained within and tolerated by the uterus with said tube projecting through the cervical os so that said source may be inserted into the cavity after the capsule is positioned in the uterus.

2. A capsule as described in claim 1, implanted in an array of similar capsules, with respective tubes passing through and tolerated by the cervical os.

3. A device as described in claim 1 in which the tube outside diameter is about 1.6 mm.

4. A device as described in claim 1 in which the tube and the cavity in said bulbous portion have an inside diameter of at least about 1 mm. so as to receive an effective radiation source of iridium-192.

5. A device as described in claim 1 in which said tube is made of nylon.

6. A device as described in claim 1 in which the outside diameter of said bulbous portion is about 6 – 10 mm.

7. A device as described in claim 1 in which said cavity contains as a radioactive source, a charge of radioactive isotope of the group consisting of iridium-192, cesium-137 and cobalt-60, about 0.3 mm. in diameter and about 15 mm. long implanted in a tube introduced into said cavity through said thin-walled tube.

8. A device as described in claim 1 in which said bulbous portion is about 3 mm. outside diameter and 4 to 5 cm. long, is normally curved substantially to conform to the shape of the inside wall of the uterus, and has an elastic memory.

9. The combination of the capsule described in claim 1 and a radioactive source having dimensions adapted to fit within said cavity in said bulbous body portion of said capsule, said source being mounted at the end of
a long tube or rod having an outside diameter small enough to fit within said thin-walled narrow tube and long enough to reach from said cavity to the open end of said last-mentioned tube so that said source may be inserted through said last-mentioned tube into said cavity.

10. The combination described in claim 9 in which said source is a charge of radioactive isotope whose specific activity is greater than that of radium.

11. The combination described in claim 10 in which said source is a charge of radioactive isotope of the group consisting of iridium-192, cesium-137 and cobalt-60.

12. The combination described in claim 11 in which said source has an outside diameter of about 0.3 mm. and a length of about 15 mm.

13. A device adapted to be inserted in and retained by the uterus, comprising a thin-walled narrow tube including an inside diameter sufficient to accomodate a source of radioactive material therein and further including an outside diameter not greater than 2 mm, so as to permit the device to be inserted into the uterus without excessive pain and to be tolerated while it remains in the uterus, with the trailing portion of the tube projecting outwardly from the uterus so that the source of radioactive material may be inserted into the tube after the device is positioned in the uterus.

14. Devices in accordance with claim 13 implanted in an array with respective tubes being retained in and tolerated by the uterus.

15. A device in accordance with claim 13 including an elongated stiffening member which is adapted to be inserted into the tube before the latter is inserted into the uterus and withdrawn before the radioactive source is inserted into the tube.

16. A device in accordance with claim 13 wherein the outside diameter of the tube is about 1.6 mm.

17. A device in accordance with claim 13 wherein the inside diameter of the tube is at least about 1 mm. so as to receive an effective radioactive source.

18. A device in accordance with claim 13 wherein the tube is made of nylon.

19. A device in accordance with claim 13 wherein the tube contains a radioactive source a charge of radioactive isotope whose specific activity is higher than radium, implanted in a tube introduced through the trailing end of the thin-walled tube.

20. A device in accordance with claim 19 wherein the charge of radioactive isotope is a member of the group consisting of iridium-192, cesium-137 and cobalt-60.

21. The combination of the device described in claim 13 and a radioactive source having dimensions adapted to fit within the thin-walled tube, the source being positioned at the end of a long tube or rod having an outside diameter small enough to fit within the thin-walled narrow tube and being long enough to reach from the lead thereof to the open end thereof so that the source may be inserted through the thin-walled tube to a point within the human body.

22. The combination in accordance with claim 21 wherein the radioactive source is a charge of radioactive isotope whose specific activity is higher than radium.

23. The combination in accordance with claim 22 wherein the charge of radioactive isotope is of the group consisting of iridium-192, cesium-137 and cobalt-60.

24. The method for treating diseases of the uterus which comprises dilating the cervical os, introducing therein the bulbous end of a capsule comprising an elongated and enlarged bulbous body portion with a cavity therein, said cavity being disposed generally longitudinally within said body portion and having a diameter sufficient to accommodate a source of radioactive material therein, said body portion being connected to a thin-walled narrow tube, said tube being arranged coaxially with said cavity so as to permit insertion of a radioactive source into said cavity through said tube, the outside diameter of said tube being small so as to permit said capsule to be retained within and tolerated by the uterus with said tube projecting through the cervical os, leaving said tube lying in the os and the vagina introitus, and thereafter introducing a radioactive source to the cavity of said bulbous body through said tube.

25. The method as described in claim 24 in which the implantation of capsules is repeated until the uterine cavity is substantially filled, and multiple implantations of radioactive sources are made through respective tubes.

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