INFLATABLE STRING FOR MARKING INTERNAL BLEEDING

Filed Sept. 13, 1963

INVENTOR

MYRON W. MAZELLAN

BY

ATTORNEY
This invention deals with an inflatable string to be swallowed by a patient for locating the area of gastrointestinal tract in which bleeding is taking place. More specifically, it relates to an orally-introduced string comprising an elongated, narrow, inflatable, sausage-like string, made of radio-transparent film, of plastic or similar material, and coated or covered with similarly-transparent blood-absorbent material, and having X-ray opaque markings thereon or theretwixt, for pin-pointing the bleeding area.

There is described in Patent 3,097,636 a string for marking internal bleeding, consisting of an absorbent tape having a weighted, orally-insertable end, and carrying radio-opaque markers. Such a tape, which is non-fluorescing under ultra-violet light, is swallowed by the patient, with the aid of sips of water. Once the weighted end reaches the stomach, the patient is instructed to continue swallowing segments of the tape, until the required length of string has entered the gastro-intestinal tract.

Thereafter, a roentgenogram of the upper abdomen is taken to clearly outline the characteristic "C-loop" of the abdomen. Then, while the patient is lying on the X-ray table, a dose of fluorescein dye is injected into an antebraib vein, and the dye is allowed to circulate for four minutes before the string is pulled out of the patient's mouth. Gloves are worn prior to withdrawal of the string to reduce the danger of possible contamination with dyed fingers. After the string is removed, it is examined under ultra-violet light for fluorescence. If the patient has been bleeding actively at the time of the test, both blood and fluorescence will be readily located on the tape.

The dye is visible as a yellow spot on the tape when examined under ultra-violet light, and the sites of the bleeding is pin-pointed by counting back the number of markers from the weighted end, and comparing this with the roentgenogram. Use of such a string has been successful in locating the bleeding site within a distance of one or two inches.

There have been some difficulties encountered with the use of such a string, including the swallowing of the limb tape, particularly by children and persons unable to swallow because of profuse bleeding, for example, and because of the highly limber and flaccid nature of the tape. One method for avoiding such difficulties is the use of a semi-rigid flexible core, such as a plastic tube, within or attached to the tape. Such a unit can be introduced by the physician, thus saving time.

As already mentioned, the duodenum contains the upper abdominal "C-loop" which readily allows passage therethrough of a tape, but does not permit passage within a rapid time, without possible damage thereto, of a rigid material. Once passage is effected past this "C-loop," there is little difficulty of further passage of even a limp tape. An ideal string, therefore, would be one which is semi-rigid and flexible until it is swallowed up to the "C-loop" (since it is much easier to force down such a string, rather than a limp one), after which it would become limp, since the limp string offers the minimum of discomfort and resistance to remove out of the gastro-intestinal tract.

An object of the present invention is to provide a string which can be swallowed in inflated form and then deflated. The invention will be more readily understood by reference to the accompanying drawing in which a preferred embodiment is described, and in which FIGURE 1 illustrates a side view, with upper tape portion partially cut open or torn away, of a deflated string of the present invention. An enlarged cross-sectional view taken along line 2-2 in FIGURE 1 is shown in FIGURE 2. FIGURE 3 depicts the view shown in FIGURE 2, in inflated condition, while FIGURE 4 is a similar view of another embodiment of the invention, in deflated condition. A similar view of still another embodiment, in deflated condition, is depicted in FIGURE 5. FIGURE 6 presents an enlarged vertical cross-sectional view of a portion of an articulated string, in inflated condition. Similar numerals refer to similar parts or corresponding parts in the various figures.

Referring again to the drawing, numeral 10 indicates generally a string of the present invention comprising an elongated radio-transparent, continuous, thin-walled, inflatable, flexible tube 11, in collapsed condition, and made of any suitable material, such as polyethylene, polyvinyl chloride, fluoropolymer, and the like. This tube is sealed off at its swallowing end 12, whereas its upper held end 13 is cemented, or otherwise attached, to plastic tip 14 having inlet 23 through which air may be introduced by blowing, insertion of a syringe-type bulb, an air bulb having a one-way valve, or the like, for the purpose of inflating tube 11.

Around tube 11 is coated, or woven, a radio-transparent absorbent cover 15, which may be of a single piece woven around tube 11, or may consist of two cloth tapes 15a and 15b, sewn together at the edges, as at 16, it being understood that the sewing is done carefully enough so as not to puncture the patient's mouth. Cover 15 is sewn at end 17, and anchored to closed end 12 of tube 11 by cement, cord, or the like, or sewn onto an appendage of the plastic tube. Also, upper end 18 of cover 15 is attached to the lower end of top 14 in a similar manner.

If two tapes, 15a and 15b, are employed for the cover, the radio-opaque markers 19 are best attached to the inner surface of a tape, such as tape 15a, by cementing, heat-sealing, or by any other means, the markers being in the form of a radio-opaque thermoplastic sheet. Also, visible, non-fluorescing and non-toxic markers, such as lines 20, of thread of another color, may be applied to the outer surface of tape 15b, in juxtaposition with markers 19, to facilitate orientation of the bleeding spot with respect to the end of the string.

When in use, the string is first soaked in cold water, and then inflated through tip 14. If a one-way valve air bulb is not employed, the inflated string may be clamped with a clamp near the upper portion 13 of the tube, so as to keep the string inflated while it is being swallowed by or inserted into the patient. After the string has been swallowed for the required distance, the tube is deflated to enable it to proceed past the duodenum and "C-loop," and thereafter removed in deflated condition.

An articulated tube such as tube 11a in FIGURE 6 is particularly advantageous because it can be bent (e.g., while passing through curvatures) much more readily than a continuous tube which has a tendency to straighten out. This articulated tube comprises inflatable spherical or cylindrical sections 11c connected with narrow tubular sections 11b.

In FIGURE 4, there is shown a deflated inflatable tube 11, having cemented or otherwise attached to one side, at 24, a cloth or other similar absorbent layer 15c. The radio-opaque markers 19 are disposed between the tube wall and the cover. If desired, the other side of tube 11 also may be similarly coated with a layer 15b of absorbent material.

FIGURE 5 discloses a cloth tube 15e, the inner surface of which is coated with a layer 22 of gas-impermeable
material, such as rubber or plastic. In this case, the cloth tube itself may be inflated, and its outer surface is adequately absorbent for string use. Markers in this case, may be cemented to the inside surface of the tube. Provision for an air inlet, such as tip 14, and a sealing of the swallowed end would be made, as in FIGURE 1.

The string 10 may be made in 30" and 50" lengths, while the inflatable tube may have an outside diameter of $\frac{3}{16}$" or $\frac{5}{32}$" (in two separate sizes), with a wall 0.0001-0.0004 inch, more or less, the tube being free of any rigidity when in inflated condition.

Although the strings of the present invention are adapted to be generally inflated with a gas, it is to be understood that inflation with liquids may be partially or completely effected and shall be considered the equivalent of gas-inflation.

I claim:

1. In a blood-absorbing string taken orally for locating bleeding in the gastro-intestinal tract, as described, and provided with radio-opaque markers along the length thereof, the improvement comprising:

   a continuous, radio-transparent elongated, collapsible thin-walled tube, serving as the core for the string, and having an open end and a swallowable closed end, and

   a layer of absorbent, radio-transparent material attached to the outside of said tube, and

   inflation medium-receiving means attached to the open end of said tube.

2. In a blood-absorbing string taken orally for locating bleeding in the gastro-intestinal tract, as described, and provided with radio-opaque markers along the length thereof, the improvement comprising:

   a continuous, radio-transparent, elongated, collapsible thin-walled flexible tube, serving as the core for the string, and having an open end and a swallowable closed end, and

   a cover of absorbent, radio-transparent material attached to the outside of said tube and serving as an expansion-limiting means for said tube.

3. A blood-absorbing string according to claim 2 in which the layer of absorbent material comprises a cloth cover.

4. A blood-absorbing string according to claim 2 in which the layer of absorbent material is attached to at least one side of said tube.

5. In a blood-absorbing string taken orally for locating bleeding in the gastro-intestinal tract, as described, and provided with radio-opaque markers along the length thereof, the improvement comprising:

   a continuous, radio-transparent, elongated, collapsible thin wall tube, said tube being articulated so as to provide wide and narrow portions, when in inflated condition, and serving as the core for the string, and having an open end and a swallowable end, and

   a cover of absorbent, radio-transparent material attached to the outside of said tube and serving as an expansion-limiting means for said tube.

References Cited by the Examiner

UNITED STATES PATENTS

3,060,972 10/1962 Sheldon 128—2 X
3,097,636 7/1963 Haynes et al. 128—2
3,125,096 3/1964 Antiles et al. 128—401
3,155,091 11/1964 Nissenbaum et al. 128—2
3,217,705 11/1965 Billings 128—2

RICHARD A. GAUDET, Primary Examiner.

SIMON BRODER, Examiner.