INSUFFLATION DEVICE

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ABSTRACT
A device for insufflating a patient's body from a source of pressurized gas. The device includes a flexible gas reservoir having an inlet port, an outlet port, and means for indicating a preselected volume of gas in the reservoir. Means are provided for connecting the gas source to the inlet port of the reservoir for filling the reservoir with the preselected volume of gas from the gas source. The device has body penetrating means for introducing gas into the patient's body, and means for pumping a selected volume of gas from the outlet port of the filled reservoir through the penetrating means and into the body.

1 Claim, 7 Drawing Figures
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INSUFFLATION DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a device for insufflating a patient's body.

2. Description of the Prior Art

Pneumography is the use of a gas as a contrast medium for radiographic visualization of the body interstices. When insufflated into a patient's body, gases separate tissues and organs in the body, and since they have lower densities than the surrounding body tissues and organs, they are delineated on X-rays and outline body organs, cavities, and intestines, to facilitate radiography. Historically, insufflation has also been utilized to dissect facial planes of tissues, such as in a tubal ligation procedure for sterilization, to inflate collapsed body structures, and for diagnostic and/or treatment of the brain (pneumoencephalography).

As a particular example of the usefulness of an insufflation procedure, an iodine based dye has been introduced into the kidneys in retrograde and intravenous pyelogram procedures to obtain X-rays of the kidneys. Although the internal structure of the kidneys is shown in the X-rays during a retrograde or intravenous pyelogram, the outline of the kidneys does not clearly appear during such a procedure, and certain problems, such as a tumor on a kidney, will not necessarily be detected through use of either of these procedures. Accordingly, a gas has been insufflated into the retroperitoneal space of the patient to separate the kidneys from the surrounding tissues and present the outline of the kidneys in sharp contrast during radiography. Moreover, it has been learned that an increasing number of patients are allergic to the dye used in retrograde and intravenous pyelograms, and the above described perirenal insufflation procedure presents a desired alternative in such a case.

It has been discovered that insufflation of the patient is best carried out through the use of carbon dioxide, due to the possible danger of gas embolism when a different gas is utilized. Since carbon dioxide is rapidly absorbed and dissolved by the body, the danger of gas embolism is minimized when carbon dioxide is used. A larger volume of carbon dioxide, relative to other gases, must be insufflated into the body due to its rapid absorption by the body and a sufficient quantity of carbon dioxide must be available for insufflation. For example, two liters of carbon dioxide is adequate for a perirenal insufflation procedure. However, it is desirable that the volume of gas insufflated into the body be known. This follows since if carbon dioxide is not used, the danger of gas embolism is present if too much gas is insufflated. If carbon dioxide is utilized for insufflation, and a given volume of gas, such as two liters, has been injected into the body without achieving the desired results, the procedure should be verified to determine whether some deficiency may be present. For example, a needle, utilized for insufflating the carbon dioxide, may have been incorrectly positioned in the patient, or the gas may have escaped into another part of the body.

In the past, insufflation has usually been accomplished by injecting gas from a pressurized gas source directly into the patient. The flow rate of the pressurized gas has been utilized to estimate the desired amount of gas for the insufflation, which has proven inadequate since the volume of pressurized gas introduced from the source is not readily determined by the flow rate of the gas. Also, the pressurized gas source has been connected to a syringe, and the pressurized gas is pumped by the syringe from the source into the patient. However, since the gas is under a relatively high pressure, relative to atmospheric pressure, the volume of gas at atmospheric pressure is still not known, and the pressure may force a plunger in the syringe out of the syringe during pumping.

SUMMARY OF THE INVENTION

A principal feature of the present invention is the provision of a device of simplified construction for insufflating a patient's body from a source of pressurized gas.

The insufflating device of the present invention includes a flexible gas reservoir having an inlet port, an outlet port, and means for indicating a preselected volume of gas in the reservoir. Means is provided for connecting the gas source to the inlet port of the reservoir for filling the reservoir. The device has body penetrating means for introducing gas into the patient's body, and means for pumping a selected volume of gas from the outlet port of the filled reservoir through the penetrating means and into the body.

A feature of the invention is that the indicating means designates when the reservoir is filled with the preselected volume of gas.

Another feature of the invention is that the indicating means may be utilized to prevent overinflation of the reservoir.

Still another feature of the invention is that the gas in the filled reservoir is retained at approximately atmospheric pressure.

Yet another feature of the invention is that the volume of insufflated gas may be determined by the pumping means.

Further features will become more fully apparent in the following description of the embodiments of this invention and from the appended claims.

DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a fragmentary perspective view, partly broken away, of the insufflating device of the present invention as connected to a source of pressurized gas;

FIG. 2 is a sectional view taken substantially as indicated along the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary perspective view of the device of FIG. 1 during filling of a reservoir in the device from the gas source;

FIG. 4 is a fragmentary plan view, taken partly in section, of the device of FIG. 1, during operation of pumping means in the device to withdraw gas from the filled reservoir;

FIG. 5 is a fragmentary elevational view on an enlarged scale, taken partly in section, of the device of FIG. 1, during operation of the pumping means to force gas through the penetrating means in the device;

FIG. 6 is a fragmentary elevational view of another embodiment of the penetrating means; and

FIG. 7 is a perspective view, partly broken away, of a package for the device of FIG. 1.
DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is shown a device, generally designated 10, for insufflating a patient's body from a source of pressurized gas designated generally 12. The insufflating device 10 includes a flexible gas reservoir 14, means 16 connecting the gas source 12 to the reservoir 14, body penetrating means 18 for introducing gas into the patient's body, and means 20 for pumping a selected volume of gas from the reservoir 14 through the penetrating means 18 and into the body.

The gas source 12 may have a valve 22 for controlling the introduction of pressurized gas from the source 12 into the connecting means 16. The connecting means 16 comprises a tube 24 which may have a nipple 26 for convenience in attaching the end of the tube remote from the gas source 14. Any suitable means, such as a sleeve 28, may be utilized to connect the other end of the tube 24 to the source 12.

The reservoir 14 is preferably relatively inelastic, and may be made from a flexible material, such as plastic. As shown, the reservoir 14 may be constructed from a pair of flexible sheets 30a and 30b, which are joined at their edges along a line 32, such as by RF sealing, to form a closed bag having an internal chamber 34.

The reservoir 14 has a push valve 36 of a type well known to the art, which defines an inlet port 38 to the reservoir. When the valve is open communication is established between the inlet port 38 and the chamber 34 of the reservoir. The nipple 26 of the tube 24 may be connected to the inlet port 38 of the reservoir, as indicated by the arrow in the drawing, and the valve is constructed to open when the nipple 26 is so attached to establish communication between the gas source 12 and the reservoir chamber 34. When the tube nipple 26 is removed from the inlet port 38, the valve 36 closes to prevent passage of air out of the reservoir 14 through the inlet port. The reservoir also has a nipple 40 secured to the reservoir which defines an outlet port 42 of the reservoir.

The reservoir includes means 44 for indicating when a preselected volume of gas is introduced into the reservoir from the gas source 12. As shown in FIGS. 1 and 2, a preferred form of the indicating means 44 comprises a balloon 45 which is secured to the reservoir and which communicates with the chamber 34. The balloon may be secured to the reservoir by a pair of annular members 47a and 47b, as best shown in FIG. 2. The annular member 47b is secured to the wall 49 of the reservoir, and the annular member 47a is snugly received in the inside of the member 47b. The open end 51 of the balloon 45 is positioned over the outside of the member 47a, as shown, and the member 47a is depressed into the member 47b to secure the balloon 45 in place. The inside of the balloon 45 then communicates with the inside of the reservoir through an aperture 53 in the reservoir wall 49. The operation of the indicating means 44 is described in greater detail below.

As illustrated in FIG. 1, the pumping means 20 includes a valve assembly 46 and a pump or syringe 48, with the syringe 48 being removably connected to the valve assembly 46 for use, as indicated by the direction of the arrow in the drawing. As best shown in FIG. 5, the valve assembly has an inlet opening 50, an outlet opening 52, and a passageway 54 which communicates with the inlet and outlet openings 50 and 52 through valves. A first one-way valve 56, such as a flap valve, is secured in the valve assembly 46 adjacent the inlet opening 50, such that the valve 56 permits the passage of gas from the inlet opening 50 into the passageway 54, but prevents passage of gas from the passageway 54 to the inlet opening 50. The valve assembly also has a second one-way valve 58, such as a flap valve, adjacent the outlet opening 52. The second valve 58 permits passage of gas from the passageway 54 to the outlet opening 52, but prevents passage of gas from the outlet opening 52 to the passageway 54.

The syringe 48 is of a well-known type, and has an outer body 60, a cavity 62, a plunger 64 slidably received in the cavity 62, and a tip 66 removably attached to a flange 68 in the valve assembly 46. When the syringe 48 is attached to the valve assembly 46, the syringe cavity 62 communicates with the passageway 54 of the valve assembly, and the syringe plunger 64 is utilized to withdraw and force gas from and into the passageway 54.

As shown in FIGS. 1 and 4, a tube 70 communicates between the outlet port 42 of the reservoir 14 and the inlet opening 50 of the valve assembly 46, and serves as means connecting the outlet port 42 and the inlet opening 50. If desired, one end 72 of the tube 70 may have a nipple 74 to facilitate connection of the tube 70 to the valve assembly 46, and the other end 76 of the tube 70 is connected to the reservoir nipple 40.

As shown in FIGS. 1 and 5, the penetrating means 18 may comprise hollow needles 78, or, as shown in FIG. 6, a flexible catheter 80 which may be secured to a hollow needle 82 having a relatively short cannula 84. The particular type of penetrating means utilized is determined by the type of insufflation procedure performed, during which the penetrating means is inserted into the patient's body, and gas is introduced through the penetrating means into the body.

The type of insufflation procedure performed also determines whether one or more needles or catheters are needed for the procedure. If a single needle or catheter is utilized for the penetrating means, the penetrating means may be connected to the outlet opening 52 of the valve assembly 46 by a tube having a sufficient length. However, if the insufflation procedure requires a pair of needles or catheters, or combination thereof, a Y-shaped connector 86 may be removably attached to the valve assembly 46, such that it communicates with the outlet opening 52, and a pair of tubes 88a and 88b may be connected between the connector 86 and the penetrating means 18 to establish communication between the outlet opening 52 and the penetrating means. If desired, the end of the tubes 88a and b remote from the connector 86 may have nipples 90a and 90b, respectively, in order that the penetrating means 18 may be conveniently attached to the nipples, as indicated by the direction of the arrow in FIG. 1. Additionally, a pair of clamps 92a and 92b of a well-known type are positioned on the tubes 88a and b, respectively, to selectivity open and close the tubes, as desired.

In operation, the tube 24 is connected to the gas source 12 by the sleeve 28, and the tube nipple 26 is secured to the inlet port 38 of the reservoir 14, as shown in FIG. 1, to open the valve 36 and establish communication between the tube 24 and the reservoir chamber 34. Next, the control valve 22 of the gas source 12,
which is preferably carbon dioxide to prevent the possibility of gas embolism to the patient, is opened to introduce the gas into the chamber 34. As the gas fills the chamber 34, the flexible walls of the reservoir expand and the reservoir inflates, as shown in FIG. 3. Once the reservoir is filled with a preselected volume of gas, the balloon 45 of the indicating means 44 expands to indicate that the reservoir has been filled with the desired amount of gas. The volume of gas retained in the chamber is primarily determined by the size of the chamber, and may be preselected according to the requirements of a desired insufflation procedure. For example, the filled reservoir may retain two liters of gas for a perineal insufflation procedure.

The balloon 45 also serves as means to prevent overinflation of the reservoir, since the balloon will burst prior to rupture of the reservoir. It is apparent that any suitable device may also be utilized to prevent overinflation of the reservoir, such as knock-out plugs.

Once the balloon 45 has inflated, the control valve 22 on the gas source is closed, and the tube nipple 26 is removed from the inlet port 38 to close the valve 36 and prevent passage of gas from the chamber 34 through the inlet port 38. When the balloon 45 is inflated, gas in the reservoir is retained at a pressure slightly greater than atmospheric pressure, and the balloon contracts to force gas from the chamber 34 through the outlet port 42 into the remainder of the device 10, thus purging air from this part of the device. When the device has undergone sufficient purging or bleeding, which may be indicated by deflation of the balloon 45, the clamps 92a and b may be used to close the tubes 88a and b and prevent further escape of gas until use of the device on the patient.

The penetrating means 18 should be properly positioned in the patient according to the particular insufflation procedure being performed, and the tube nipples 90a and b may then be connected to the penetrating means preparatory to use of the device. If the clamps 92a and b have been used to close the tubes 88a and b, they are then opened to establish communication between the valve assembly 46 and the penetrating means 18.

Next, the plunger 64 of the syringe 48 is partially retracted from the syringe outer body 60, as indicated by the direction of the arrow in FIG. 4, and gas is then withdrawn from the chamber 34 through the tube 70, the first valve 56, and the passageway 54 into the syringe cavity 62, as indicated by the direction of the arrows in the drawing. The second valve 58 prevents passage of gas from the outlet opening 52 to the passageway 54 when the syringe plunger 64 is retracted. The syringe plunger 64 is then pushed into the syringe outer body 60, as indicated by the direction of the arrow in FIG. 5, and gas, previously retained in the syringe cavity 62, is forced through the passageway 54, the second valve 58, the tubes 88a and b, the penetrating means 18, and into the patient’s body, as indicated by the direction of the arrows in the drawing. When the syringe plunger 64 is pushed into the syringe body 60, the first valve 56 prevents passage of gas from the passageway 54 to the inlet opening 50 and back to the reservoir chamber.

As shown in FIG. 1, the syringe body 60 may be calibrated by indicia 94, and the indicia 94 may be utilized to withdraw a selected volume of gas from the reservoir chamber when the syringe plunger 64 is retracted from the syringe body 60, by retracting the plunger to a selected indicium 94. The selected volume of gas is then forced into the patient’s body when the syringe plunger is pushed into the syringe body. The total volume of gas injected into the patient’s body may readily be determined by counting the number of repetitive plunger strokes of the syringe. Alternatively, if the total volume of gas retained in the filled reservoir is approximately equal to the desired amount of gas to be insufflated into the patient, the pumping means 20 may be used until the reservoir has collapsed and the gas has been removed from its chamber.

As pumping of gas from the filled reservoir proceeds, the flexible walls of the reservoir slowly settle as the gas is removed from its chamber. During this time, the gas in the reservoir chamber remains at approximately atmospheric pressure since the reservoir is relatively inelastic and does not compress the gas in the chamber, other than that caused by the slight weight of the reservoir walls itself. Since the gas remains at approximately atmospheric pressure in the chamber, the volume of gas at atmospheric pressure introduced into the patient during insufflation may readily be determined and controlled by the pumping means 20. Although the pumping means has been described with use of a syringe, it is apparent that any suitable pump may be utilized which may pump gas in a manner such that the volume of gas pumped is known.

A package 94 for the insufflation device is shown in FIG. 7, which comprises a box 95, a tray 96 for retaining components of the device, and a cover 99 for the box, such as a lid. The reservoir 14 of the device may have a pair of flaps 97 extending from opposing ends of the reservoir, and the reservoir may be secured in the lower part of the box 95 by attaching the flaps 97 to opposing sides of the box by suitable means, such as staples 98. The component tray 96 is placed in the box 95 over the reservoir 14, and the cover 99 is closed for the packaging of the device. During use of the device, the reservoir is conveniently retained in the box and may be inflated from the gas source in this location.

The foregoing detailed description is given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

We claim:

1. A device for use with a source of pressurized gas for insufflating a patient’s body, the device comprising a gas reservoir for retaining a volume of gas at approximately atmospheric pressure, said reservoir formed from a gas impervious flexible material and including an inlet port and an outlet port; balloon means for automatically releasing gas from said reservoir to the atmosphere when said gas reaches a predetermined pressure, thereby preventing overinflation of said reservoir; first conduit means communicating with said inlet port and connectable to said source of pressurized gas for the filling of said reservoir; body penetrating means for introducing gas into the patient’s body; and second conduit means connecting said reservoir outlet port and said body penetrating means and including means for pumping a selected volume of gas from said reservoir to said body penetrating means.