United States Patent [19]

Pannier, Jr. et al.

[11] **3,874,369**

[45] **Apr. 1, 1975**

[54] **METHOD OF MONITORING VENOUS OR ARTERIAL PRESSURE**

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[22] Filed: **Nov. 7, 1973**

[21] Appl. No.: **413,648**

Related U.S. Application Data

[60] Division of Ser. No. 126,439, March 22, 1971, Pat. No. 3,786,810, which is a continuation-in-part of Ser. No. 885,803, Dec. 17, 1969, abandoned.

[52] **U.S. Cl.** ..... **128/2.05 D,** 128/2.05 E

[51] **Int. Cl.** **A61b 5/02**

[58] **Field of Search** ..... 128/2.05 D, 2.05 E, 2.05 R

[56] **References Cited**

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[57] **ABSTRACT**

A method of monitoring venous or arterial pressure with the aid of an elongated element comprising a blood pressure transmitting vehicle positioned in a body lumen. The elongated element may be a catheter, piezoelectric transducer means carried in the catheter, a coaxial cable, or other sensing means, which may or may not have a lumen therethrough but which may be connected to apparatus for indicating or recording central arterial pulse wave forms and other heart actions. The monitoring of venous or arterial pressure may be carried on during the advancement of the distal end of the element from the point of entry to its desired ultimate position, as well as thereafter.

6 Claims, 2 Drawing Figures

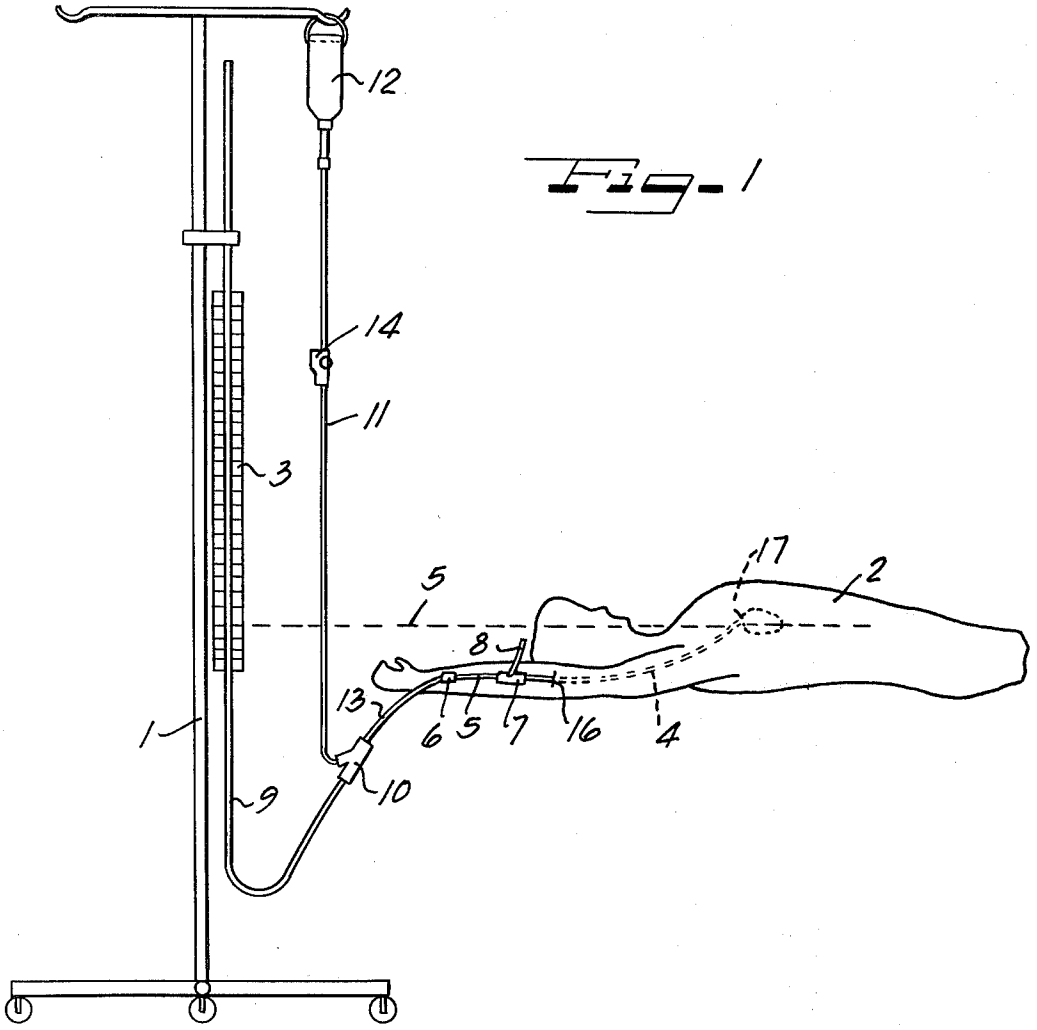


Fig. 1

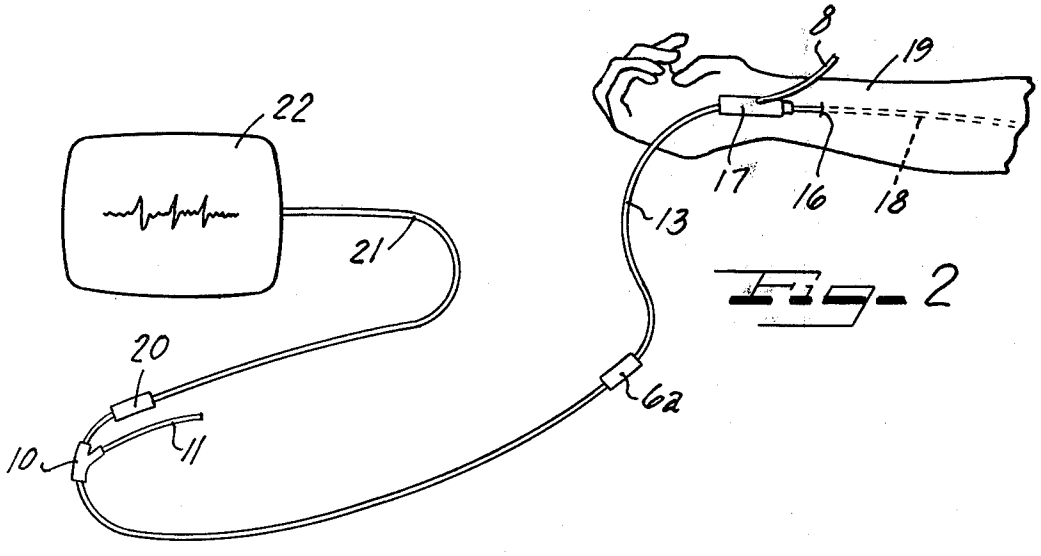


Fig. 2

METHOD OF MONITORING VENOUS OR ARTERIAL PRESSURE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a division of our copending application entitled, "Placement Apparatus For Positioning An Elongated Element In A Body Lumen," filed Mar. 22, 1971, Ser. No. 126,439, now U.S. Pat No. 3,786,810 dated Jan. 22, 1974, which said application was a continuation-in-part of a then pending application entitled, "Catheter Placement Unit," filed Dec. 17, 1969, Ser. No. 885,803, now abandoned; and the present application claims only subject matter disclosed in the parent application Ser. No. 126,439.

SUMMARY OF THE INVENTION

Monitoring of central venous or arterial pressure has become increasingly popular where a serious condition of a patient resulting from a wound, a surgical operation, or other treatment, requires a knowledge on the part of the surgeon as to the condition of the patient and especially the heart of the patient during the treatment procedure. Such monitoring provides a surgeon with a number of parameters of information concerning the activity of the patient's heart during the treatment procedure, utilizing a catheter disposed in the body lumen of the patient with a distal end reaching to a point adjacent to, at, or actually in the heart of the patient and the indications may be seen on a manometer, or through a circuit including a transducer which converts fluid impulses to electrical impulses and may be in connection with an oscilloscope or other indicating or recording device. An elongated element may be advanced which need not necessarily be a catheter, but may be a piezoelectric transducer means carried within a catheter, a coaxial cable, or some other sensing means, which may not have a lumen therethrough. Insofar as we are aware, monitoring of venous or arterial pressure from the point of body puncture, which is usually within the arm of a patient to a point in the thoracic cavity close to or even within the heart of the patient, while the elongated element is being advanced was not considered practical heretofore. Presumably this was because there was no way of advancing the catheter with the smoothness necessary to produce effective and accurate indications of the central pulse contour. Blood monitoring from the point of body puncture to the ultimate position of the elongated element, while the element is being advanced aids the physician or surgeon in the proper positioning of the element by virtue of the variants in the amplitude of the impulses as the element is advanced.

The elongated element may be advanced smoothly and completely shielded as to the portion entering the patient's body eliminating the necessity of a sterile field of operation for the advancement of the element and with a surgeon's hands immediately adjacent the needle hub whereby the surgeon acquires an accurate feel of the movement of the elongated element in the body lumen and the advancement of the element may be sufficiently smooth to permit proper monitoring during advancement. Only one operator is needed to advance the element. The element need not necessarily be advanced through a needle but may be advanced through a prepositioned means or a preformed cannulated entry into the body of the patient.

The means for advancement of an elongated element into the body of a patient, permitting monitoring during the advancement of the element, are set forth, described and claimed in the aforesaid parent application, Ser. No. 126,439, of which this application is a division.

BRIEF DESCRIPTION OF THE FIGURES OF THE DRAWING

FIG. 1 is a diagrammatic showing of our method of monitoring venous pressure from the point of entry of a catheter to its destination in the thoracic cavity; and

FIG. 2 is a diagrammatic showing of our method of monitoring arterial pressure from the point of entry of an elongated element to the termination of the distal end of the element in the thoracic cavity.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 and 2 are diagrammatic in their disclosure, in view of the fact that apparatus for the positioning of an elongated element in the body lumen is fully shown, described, and claimed in our copending application Ser. No. 126,439, and therefore FIGS. 1 and 2 merely indicate the use of the apparatus rather than its specific structure to indicate the performance of the methods. While central pressure monitoring is most commonly accomplished by passing an elongated element into the forearm or wrist region of the patient, shown herein by way of example but not by way of limitation, such is not essential since conditions may indicate the placement of the elongated unit elsewhere.

In FIG. 1 there is illustrated a simple arrangement for monitoring venous pressure, and where a permanent record is not intended to be kept. In this arrangement, most frequently the elongated element may be in the form of a catheter and so by way of example that is what is shown and described, although other types of elongated element might be used for the purpose.

In this instance, an ordinary hospital stand **1** may be disposed near the patient **2**, and this stand carries a manometer **3** from which the monitoring readings are observed. The portion of a catheter **4** which enters the patient's body is initially enclosed sterilely within a split sheath or conduit **5** removably attached to a catheter hub **6**. The catheter is advanced by pushing or pulling the sterile sheath through a needle hub **7** as indicated at **8** and when the catheter hub becomes joined with the needle hub the sheath is automatically freed from its engagement with the catheter hub, and is pulled cleanly from the catheter and discarded. The manometer **3** is connected by a tube **9** to one arm of a Y-fitting **10**. The other arm of the Y-fitting is connected through a tube **11** to a container **12** for infusion liquid, hanging from the top of the stand **1**. The leg of the Y-fitting is connected to a tube **13** leading from the catheter hub **6**, and which tube is in communication with the catheter. Flow of infusion liquid through the tube **11** is controlled by a valve or clamp **14**, and flow through other tubing may likewise be controlled, if so desired. A manometer **3** is also disposed preferably so that the zero point on the manometer is even with the heart of the patient as indicated by the dotted line **15**.

At the outset, the catheter is flushed out with sterile liquid, to eliminate sterilization residue and air, as well as fill the catheter and associated tubing with liquid. Flow of infusion liquid is then cut off by the clamp **14** and the remainder of the tubing need not be discon-

nected. Venipuncture is then made with the needle, frequently in the Basilic vein, or one connecting therewith, in the arm. With the flow of infusion liquid cut off, the liquid level in the manometer tube will drop until it reaches a level equaling the back pressure created by the blood pressure in the vein and the relationship of this new level to the zero mark on the manometer scale indicates the venous pressure. Since the cardiovascular system pulsates with each heartbeat, there will be a pulsation of fluid level in the manometer and those pulsations will vary as the catheter serving as a blood pressure transmitting vehicle is advanced from the point of entry into the body indicated at **16**, to the desired position at or adjacent the heart as indicated at **17** in the superior vena cava or other location within the chest which gives the attending surgeon an indication of the venous pressure at each location during advancement of the catheter from the point of entry in the peripheral vein to its ultimate destination. Monitoring continuously during advancement of the elongated element or catheter keeps the doctor fully aware of the patient's condition, and aids in the advancement of the catheter, since a sudden drop or cessation of pulsations will indicate that the catheter tip is obstructed or in contact with the wall of the vein and adjustments may immediately be made before there is any injury to the patient. The magnitude of the pulsations will also indicate to the attending surgeon when the distal end of the catheter is properly located.

In the case of monitoring arterial pressure, an elongated element **18** may be inserted through the needle into the arm **19** of the patient. If the elongated element **18** is a catheter, one leg of the Y-fitting **10** is connected to a pressure transducer **20** which transforms the fluid impulses to electrical impulses, and then by way of a line **21** to an oscilloscope **22** upon which the impulse pattern will be established.

If the elongated element, comprising the blood pressure transmitting vehicle, is a coaxial cable, a transducer carried by a catheter or on a cable, or some similar sensing device, it will be engaged by a hub-like element ***6a*** to which the initial protective sheath **13** is removably attached and then may be directly connected to any suitable amplification means and recording means for later usage on a computer, and the oscilloscope, all in a known manner and utilizing available equipment. In this instance, the Y-fitting **10** and transducer **20** as well as the tube **11** leading to the infusion container **12** might be dispensed with. As a result of the arrangement shown in FIG. **2** a recording of the patient's condition may be had and the various parameters may be obtained from the central pulse contour. Thus, a record may be kept for future reference as well as have the pulse contour visible to the attending physician or surgeon to watch during an operation or while attending the patient in other ways. In either case, monitoring begins from the point of entry **16** and continues through the advancement of the elongated element, and of course thereafter. Monitoring during advancement of the element denotes to the surgeon variations in amplitude of the impulse wave form on the oscilloscope screen and aids the surgeon in advancing the element as above discussed, and also denotes to the surgeon when the tip of the element has reached a desired position. The other parameters of information will be noted by the surgeon during advancement of the elongated element, whereby monitoring during advancement of the element is a very important factor as well as monitoring after the element has been advanced.

The invention claimed is:

1. A method of monitoring pulsations and pressure of the blood, including the steps of:

entering an elongated element comprising a blood pressure transmitting vehicle into a peripheral blood vessel of a patient,

smoothly advancing said element, proximally connected to indicating means, through said blood vessel and connecting blood vessels to a point at or adjacent the heart of the patient, and

through said element and with the aid of said indicating means continuously monitoring the pulsations and pressure of the blood during advancement of said element from the point of entry to its ultimate destination, as well as thereafter.

2. The method of claim **1**, including the step of utilizing a manometer as said indicating means to indicate the pulsations and pressure of the blood as reflected through said elongated element as it is advanced from said point of entry to its ultimate destination as well as thereafter.

3. The method of claim **1**, including the step of utilizing as said indicating means a pressure transducer and an oscilloscope to indicate the pulsations and pressure of the blood as reflected through said elongated element as it is advanced from said point of entry to its ultimate destination as well as thereafter.

4. The method of claim **1**, wherein said element embodies a sensing device, and including the step of utilizing electrical indicating means connected to the sensing device to indicate the pulsations and pressure of the blood as reflected through said elongated element as it is advanced from said point of entry to its ultimate destination as well as thereafter.

5. The method of claim **1**, including the steps of utilizing a coaxial cable as said element, and electrically connecting said cable to electrical indicating and recording means to indicate the pulsations and pressure of the blood as reflected through said elongated element as it is advanced from said point of entry to its ultimate destination as well as thereafter.

6. The method of claim **1**, including the steps of utilizing a catheter carrying a sensing device as the elongated element, and electrically connecting said sensing device through said catheter to electrical indicating means to show the pulsations and pressure of the blood as reflected through said elongated element as it is advanced from said point of entry to its ultimate destination as well as thereafter.

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