

[54] CATHETER PLACEMENT DEVICE
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Primary Examiner—Dalton L. Truluck
 Attorney, Agent, or Firm—W. Edward Johansen

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 128/DIG. 16

[51] Int. Cl. A61m 05/14

[58] Field of Search 128/214.4, 221, 215, 343,
 128/345, DIG. 16

[57] **ABSTRACT**

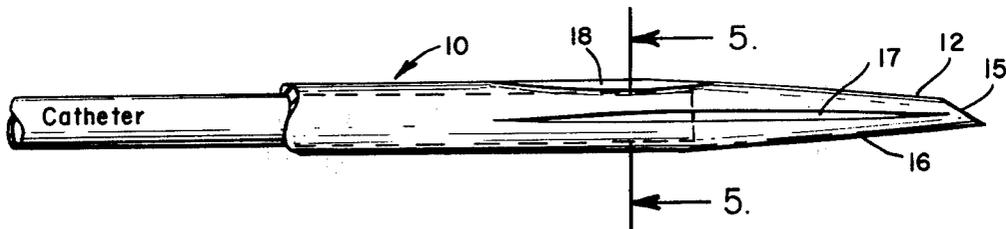
The invention is a flexible cannula for introducing a catheter into a vein during a surgical cutdown procedure. The cannula includes a hollow plastic member having a cylindrical portion and an integral conical portion with a truncated tip and two pairs of longitudinal slits one of which pairs extends nearly to the truncated tip so that the conical portion is split open when a catheter is moved through the cannula toward its tip.

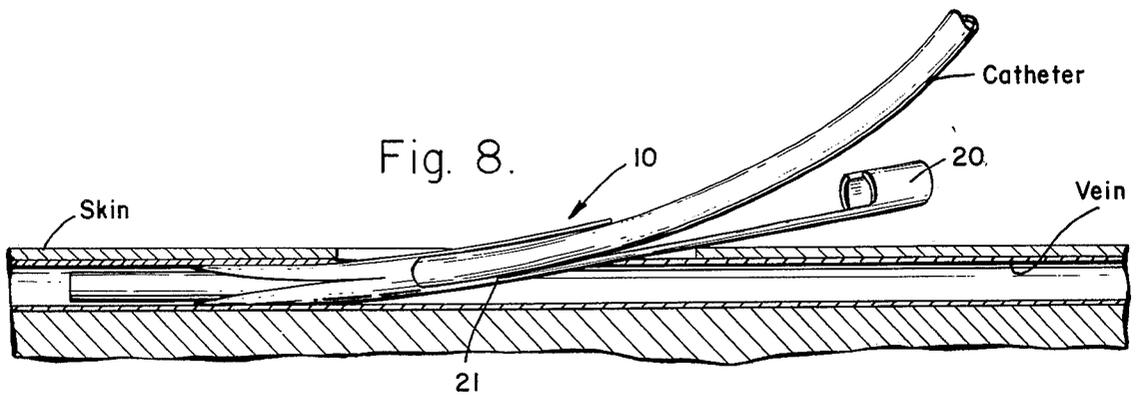
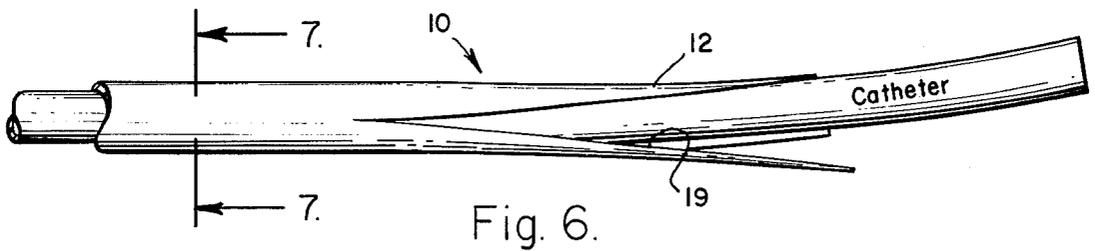
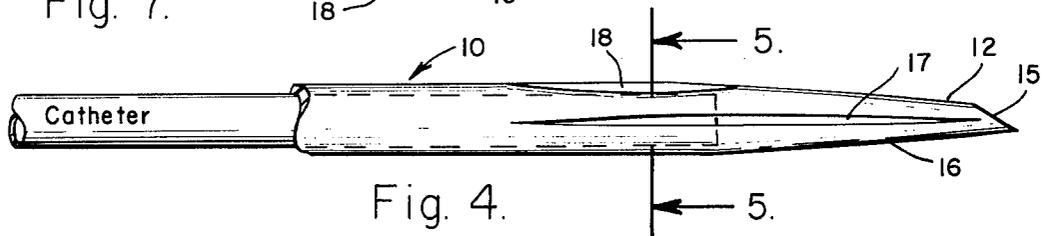
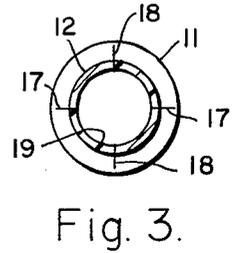
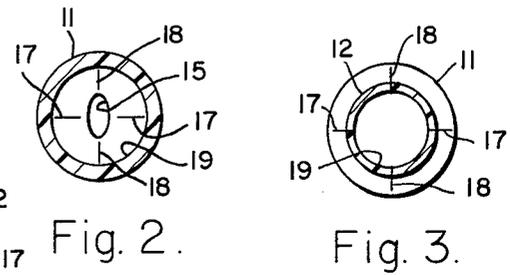
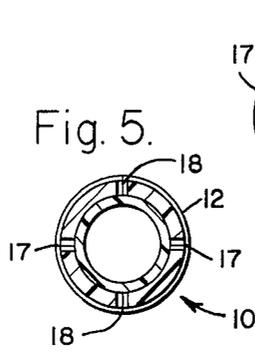
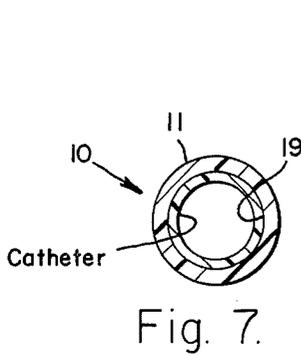
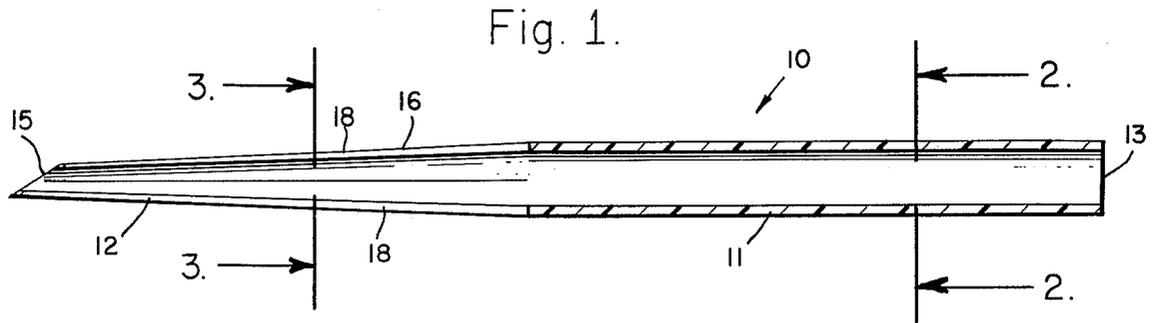
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8 Claims, 8 Drawing Figures





CATHETER PLACEMENT DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to improvements in a catheter placement device, and more particularly to an intravenous catheter placement device for introducing a catheter into a vein during a surgical cutdown procedure.

2. Statement of the Prior Art

One prior art device for placing a catheter percutaneously is taught by Douglas MacGregor in his U.S. Pat. No. 3,550,591, entitled "Intravenous Catheter Unit", issued Dec. 29, 1970. This unit provides a cannulated needle about the outer surface of the catheter, which needle is split longitudinally such that when the needle is removed from the patient, the needle can be peeled back, removed from the catheter, and discarded. This unit has eliminated the problem of protecting the catheter from the needle once the needle is removed from the patient, but the difficulty in finding materials stiff enough for use as a needle and still pliable enough to be removed from the catheter as intended has been a problem. This problem of finding such a material has been mentioned by Ralph D. Alley and Davis S. Sheridan in their U.S. Pat. No. 3,633,579 entitled "Catheter Placement Device and Method", issued to them on Jan. 11, 1972. Their solution to this problem is to use a flexible cannula having a needle or stylet through the center bore thereof with the point extending beyond the exposed end of the cannula. The combined unit, cannula and needle, is inserted through the skin and into the vein of a patient. The needle is then withdrawn and the cannula permitted to maintain its position in through the skin and into the vein of the patient. A long flexible catheter of matching size or of a smaller diameter is then inserted into the flexible cannula and is threaded through the cannula into the vein of the patient an appropriate distance.

The above prior art devices are percutaneous catheter placement units, which cannot always be used in an emergency where a patient's vein has collapsed. In such an emergency, a doctor will make a surgical incision or cutdown in the skin and vein so that the distal end of a catheter can be inserted directly into the vein and threaded a desired distance into the vein. The requisite skill for threading a catheter into a collapsed vein is similar to that required for sticking one's finger into a collapsed balloon, the neck of which is comparable in its diameter to the diameter of one's finger. Usually the doctor will insert a catheter of a smaller diameter than that of the inner diameter of the vein. This is not the best possible solution because the larger the catheter is, the more vital fluids are received by the patient at the time when he needs them.

SUMMARY OF THE INVENTION

In view of the foregoing factors and conditions characteristic of the prior art, it is a primary object of the present invention to provide a flexible cannula which will give sufficient structural support to a collapsed vein during a surgical cutdown of the vein so that the largest possible catheter may be used.

It is another object of the invention to provide a flexible cannula which can be split longitudinally such that, after the catheter has been placed inside the vein, it can be withdrawn easily from the vein and removed from the catheter.

It is still another object of the invention to provide a catheter placement device consisting of a single plastic component which is of such simple design that it is inexpensive to fabricate.

In accordance with an embodiment of the present invention, a catheter placement device for introducing a catheter into a vein of a patient during a surgical cutdown procedure includes a hollow plastic member having a conical portion with a base and a truncated distal end, the conical portion also including a first set of longitudinally disposed slits extending to a point substantially adjacent to the distal end and adapted to split apart thereat when a catheter is moved through the plastic member toward the distal end.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims.

Other objects and many of the attendant advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description and considered in connection with the accompanying drawing in which like reference symbols designate like parts throughout the figures.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-sectional view of a cannula constructed in accordance with the principles of the invention.

FIG. 2 is a cross-sectional view taken along the lines 2—2 of FIG. 1.

FIG. 3 is a cross-sectional view taken along the lines 3—3 of FIG. 1.

FIG. 4 is a partial cross-sectional view of the cannula into which a catheter has been inserted.

FIG. 5 is a cross-sectional view taken along the lines 5—5 of FIG. 4.

FIG. 6 is a partial cross-sectional view of the cannula through which the catheter has passed.

FIG. 7 is a cross-sectional view taken along the lines 7—7 of FIG. 6.

FIG. 8 is a schematic drawing of the preferred embodiment as it is being used in accordance with the principles of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Briefly, the present invention is a catheter placement device for introducing a catheter into a vein during a surgical cutdown of the skin and vein of a patient. The catheter placement device is a flexible cannula which is stiff enough to provide structural support to a collapsed vein during the introduction of a catheter therein. The stiffness of the cannula is derived from the use of polyethylene plastic tubing which is heated, drawn, and cooled to form a conical section of tubing. It is the original inner diameter of the tubing that determines the outer diameter of the catheter which can be placed in the vein. The much narrower conical section expands to allow the catheter to pass through it, because there is a plurality of longitudinal slits disposed along the conical section of the tubing. By cutting these slits, as described hereinafter sufficient structural stiffness is retained to enable the flexible cannula to support a collapsed vein during the introduction of a catheter therein.

The invention can best be understood by reference to FIG. 1 wherein a hollow, flexible cannula 10 of polyethylene plastic has a cylindrical portion 11 of a uniform inner diameter and a conical portion 12 coaxially contiguous to the cylindrical portion 11. The cannula 10 has a proximal end 13 at the end of the cylindrical portion 11. The inner and outer diameters of the cylindrical portion 11 are shown in FIG. 2 as one looks through the flexible cannula 10 at the proximal end 13 thereof. With reference to FIG. 3, a cross-sectional view of the cannula 10 near the middle of its conical portion 12 shows the inner and outer diameters as one looks through the cannula 10 toward the proximal end 13 thereof. The cannula 10 has a distal end 15 opposite the proximal end 13 and the conical portion 12 is truncated near the distal end 15 to provide a narrower tip for inserting the cannula 10 into the vein.

Structural stiffness of the flexible cannula 10 is obtained by using a polyethylene plastic tubing having a wall thickness (which is defined to be outer diameter minus inner diameter, divided by two) such that after it has been heated, drawn to form a gradual longitudinal taper 16, and quenched in water, it retains a wall thickness sufficient to withstand the compressive force placed on the cannula 10 as it is pressed into the vein. In the prototype model of the invention, polyethylene plastic tubing was used having an outer diameter of one-quarter of an inch and an inner diameter of five thirty-seconds of an inch, i.e., the tubing had a wall thickness of three sixty-fourths of an inch.

It has been determined by the inventor that different sizes of polyethylene plastic tubing may be used to provide catheter placement devices for placing catheters of varying sizes. It should also be noted that tubing of other plastic materials may be used to form alternative embodiments of the invention. It should further be noted that the taper 16 must be gradual enough to allow an even and easy expansion of a collapsed vein so that the vein will not be torn. However, if the taper 16 is too gradual then the cannula 10 will lose necessary structural stiffness. The most advantageous result has been obtained when the taper 16 was in the range of 10° to 20° measured by the longitudinal slope of the conical portion 12 of the cannula 10 relative to the cylindrical portion 11 thereof. Although larger and smaller tapers will work, they may not be as suitable as those in the above range.

The flexible cannula 10 has two pairs of longitudinal slits 17 and 18 disposed along its conical portion 12. One pair of slits 17, shown in FIG. 1 extends from the base of the conical portion 12 to a point substantially adjacent the distal end 15 of the cannula 10 (where substantially adjacent is defined to be approximately two-tenths of a millimeter). It has been determined that the point substantially adjacent the distal end 15 must be close enough so that when a catheter is pushed through the cannula 10, it will split open the first pair of slits 17.

The second pair of slits 18 is best illustrated in FIG. 4. This pair of slits 18 extends from the base of the conical portion 12 to about the middle of the conical portion. It has been found that by not extending this second pair of slits 18 to the same point as the first pair of slits 17, virtually all of the structural stiffness that the flexible cannula 10 would have without the slits may be maintained.

In accordance with the presently preferred embodiment of the invention, the two pairs of slits 17 and 18, orthogonally disposed to each other, are advantageous because they enable a catheter having a uniform inner diameter, such as shown in FIG. 5, to slide freely within the cylindrical portion 11 of the cannula 10 and to still be able to be pushed easily through the conical portion 12 thereof. Referring again to FIG. 4, one can see that as the catheter is pushed forward into the conical portion 12 of the cannula 10 the pairs 17 and 18 of slits enable the wall 19 of the cannula 10 to expand.

It has been found that only the first pair of slits 17 is required for the advantageous operation of the invention, however, the second pair of slits 18 increases the effectiveness of the invention because the catheter may be more evenly and easily threaded into the vein.

Referring now to FIG. 6, the catheter has split open the cannula 10 by breaking apart the first pair of longitudinal slits 17 and has pushed through into the vein. The catheter has the same outer diameter in the vein as it does in the cylindrical portion 11 of the cannula 10 as shown in FIG. 7.

Referring now to FIG. 8, the presently preferred embodiment of the invention also has a tab 20 contiguous to the proximal end 13 thereof which a doctor grasps in order to withdraw the cannula 10 from the patient's vein. The tab 20 is not a necessary feature of the invention, but it is very useful in removing the cannula 10 from the vein. The inclusion of the tab 20 allows the doctor holding the catheter in place with one hand to withdraw the cannula 10 by grasping the tab 20 in his other hand and pulling the cannula 10 out of the vein. It is advantageous that the doctor need not change his hands in order to withdraw the cannula 10 because it is awkward to do so.

One slit 21 of the pair of longitudinal slits 17 may advantageously be extended to the proximal end 13 of the cannula 10 so that the cannula 10 can be forced apart and removed from the catheter after it has been withdrawn from the vein.

Referring again to FIG. 8, after a surgical outdow of the skin and vein of a patient has been performed, the cannula 10 has been inserted into the vein. A catheter is inserted into the cannula 10 (as shown in FIG. 4), expanding the wall 19 of the conical portion 12 thereof. As the catheter is pressed further into the cannula it splits open the first pair of slits 17 of cannula 10 at the distal end, expands the inner diameter of the conical portion 12, and is threaded an appropriate distance into the vein. A doctor may then grasp the tab 20 and withdraw the cannula 10 from the vein, and leaving the catheter in place by sliding the cannula 10 back along the catheter at which time he may remove the cannula 10 from the catheter by prying apart the cannula 10 along the extended longitudinal slit 21.

From the foregoing it can be seen that a flexible cannula has been described. The cannula is of sufficient stiffness to provide structural support to a collapsed vein. Additionally, it has been noted that the flexible cannula may be longitudinally split so that after it has been withdrawn from the vein it may be removed from the catheter. Furthermore, it should be noted that the sketches are not drawn to scale and that the thicknesses and distances of and between various figures are not to be considered significant.

Accordingly, it is intended that the foregoing disclosure and showings made in the drawing shall be consid-

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ered only as illustrations of the principles of the invention.

What I claim is:

1. A catheter placement device for introducing a catheter into a vein of a patient during a surgical cut-down procedure, comprising:

a hollow plastic member including a conical portion having a base and a truncated distal end, said conical portion also including a first set of longitudinally disposed slits extending from said base axially along said conical portion to a point substantially adjacent said distal end but spaced inwardly therefrom and adapted to split thereat when a catheter is moved through said hollow plastic member toward said distal end the unsplit portion of said distal end initially retaining rigidity enough to dilate a collapsed vein.

2. The catheter placement device according to claim 1, also comprising a second set of slits in said conical portion extending from said base to a point intermediate said distal end, and wherein each of said sets of slits include two essentially oppositely disposed slits.

3. The catheter placement device according to claim 1 wherein said hollow, plastic member has a cylindrical

portion coaxially contiguous to said base of said conical portion.

4. The catheter placement device according to claim 3 wherein the taper of said conical portion relative to said cylindrical portion is in the range of 10° to 20°.

5. The catheter placement device as in claim 4 wherein said first set of slits includes two slits, and a second set of slits includes two longitudinally disposed slits along said conical portion extending from said base to a point intermediate to said distal end and said base.

6. The catheter placement device according to claim 5, wherein said device includes a tab extending from the open end of said cylindrical portion.

7. The catheter placement device according to claim 6 wherein one of said first set of slits extends from the base of said conical portion to the open end of said cylindrical portion of said hollow, plastic member.

8. The catheter placement device according to claim 1, wherein said hollow plastic member is of polyethylene plastic material in tubing form, said conical portion being a heated and drawn portion forming a gradual longitudinal taper.

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