ABSTRACT: An intravenous catheter assembly in which a separable gripping hub integrates a rigid cannula and flexible catheter for retaining them against relative movement during a venipuncture and permitting relative longitudinal movement after the flexible catheter has been in place and the cannula is to be withdrawn; the gripping hub including hinged jaws and a circumferential pressure band; a base plate and separate clamp parts; and a transverse clamp plate; the latter gripping heads including means for gripping a flexible protective sheath; the cannula being connected at its rear end to a flexible, withdrawing wire, and a protective rigid housing into which the cannula is withdrawable while the flexible sleeve protects against contamination of blood etc.
INTRAVENOUS CATHETER APPARATUS WITH CATHETER TELESCOPED ON OUTSIDE OF PUNCTURING CANNULA

My invention relates to an intravenous catheter apparatus for inserting a flexible venous catheter into a patient's vein. These flexible venous catheters are often inserted into a patient's vein so he can move his arm without a rigid cannula gouging into his vein.

There are basically two types of intravenous catheter apparatus. One has the flexible catheter on an outside surface of the puncturing cannula and the other has the flexible catheter fed down through the cannula's bore. The present invention deals with the former type while a separate application filed on even date (entitled "Intravenous Catheter Apparatus with Catheter Telescopied Inside Puncturing Cannula") relates to the latter type.

In the past, intravenous catheter apparatus of the former type (catheter outside cannula) required a rigid puncturing cannula or stilet which extended along the entire catheter's bore to an enlarged handle or hub at a rear of the cannula or stilet. The nurse or physician made the venipuncture by pushing against this rear hub or handle. These catheter-cannula combinations were limited in length to about 3 1/4 inches because a longer cannula or stilet would bend too easily and was hard to control when making the venipuncture. This type of apparatus has sometimes been called an "intravenous needle" because it was basically a standard hypodermic needle with an intravenous catheter or sleeve telescoped over the needle.

In my invention, I have provided a flexible catheter that fits over a rigid puncturing cannula, which catheter can be considerably longer than the cannula. The cannula has a long flexible wire connected at its rear end for pulling the cannula out through the catheter bore after venipuncture. Hence, my catheter can be of any length desired, for example 8 or 9 inches long. Some doctors prefer to have a long catheter in a patient's vein because the intravenous solution flushes into the vein at a considerable distance from the puncture point and decreases the chance of chemical phlebitis at the puncture point.

For making the venipuncture, the operator applies axial force to a grasping hub which squeezes the catheter against the cannula. After the venipuncture has been made the hub splits apart so it can be removed from the catheter.

My invention can be better understood with reference to the various embodiments of my invention shown in the attached drawings, in which:

FIG. 1 is a side elevational view of the intravenous catheter apparatus;
FIG. 2 is a side elevational view of the intravenous catheter apparatus showing the catheter inserted into a patient's vein;
FIG. 3 is an enlarged fragmentary sectional view of the catheter-cannula combination with the cannula pulled out of the catheter;
FIG. 4 is an enlarged side elevational view of a first embodiment of my split hub;
FIG. 5 is an enlarged cross-sectional view of this first embodiment taken along line 5-5 of FIG. 2;
FIG. 6 is an enlarged cross-sectional view of this first embodiment taken along line 6-6 of FIG. 2;
FIG. 7 is a top plan view of a second embodiment of my split apart hub;
FIG. 8 is a side elevational view of this second embodiment showing a removable cam locking member;
FIG. 9 is a front elevational view of this second embodiment hub;
FIG. 10 is a top plan view of a third embodiment of my split apart hub;
FIG. 11 is a side elevational view of this third embodiment hub; and
FIG. 12 is a front elevational view of this third embodiment hub.

Referring to these drawings, the intravenous catheter apparatus of my invention includes a rigid puncturing cannula 1 with a pointed end protruding slightly from a forward end 3 of a catheter 2 telescoped on an outside surface of this cannula. The cannula 1 is considerably longer than the catheter 2 and has a flexible wire 5 with one end attached to the cannula's rear end. This wire extends through a bore of the catheter and has a handle 6 on an opposite end. After a venipuncture has been made, the nurse or physician can pull on wire 5 and remove the cannula from the catheter leaving only the long flexible catheter in the patient's vein. As he is pulling out the cannula, a flexible inner sheath 7 connected between the catheter and wire 5 encases the wire which might have blood on the cannula and protects him from contamination.

Inside flexible sheath 7 is a cannula housing 18 which is removably attached to an outside of a hollow adapter 15, which adapter has a tapered inner surface 16 for attaching to an administration set. This cannula housing protects the cannula which also might be covered with blood as it is withdrawn. As the operator pulls out the wire, a shoulder 25 at a rear of the cannula abuts a closure 20 across the cannula housing's mouth 19. This closure 20 has an opening 21 that is large enough for wire 5 to pass but not large enough for cannula 1 to pass. Thus, the operator by pulling on wire 5 can pull the entire cannula housing 18 from hollow adapter 15 so this adapter can receive an administration set or a plug 17. FIG. 3 shows closure 20 crosshatched in a plastic material with a molded opening 21. The closure could also be of a rubber material with wire 5 threaded through it.

In the foregoing description of the catheter-wire-cannula combination, I have used the term "wire" to describe an elongated flexible member used to pull out the cannula. While metal is often associated with the term "wire," I do not use wire in this limited sense. A metal wire has worked very satisfactorily in my invention but the wire could also be of a material other than metal. For instance, it could be of a thermoplastic material with a high tensile strength. An important thing, however, is that the wire is flexible. The catheter-wire-cannula combination is rigid along the length of the cannula but is flexible rearwardly of the cannula. Hence, if an operator laterally moves the flexible rearward portion of the catheter-wire-cannula combination while making the venipuncture, this movement is not transmitted to the rigid portion. The operator has full control when making the venipuncture through his grasp on hub 9 which surrounds the rigid portion of the combination.

In the drawings, I have shown three hub embodiments which grip the catheter and cannula together for the venipuncture. The first embodiment is shown in FIGS. 4, 5 and 6; the second embodiment in FIGS. 7, 8 and 9; and the third embodiment in FIGS. 10, 11 and 12.

The first embodiment (FIGS. 4—6) has a sheath receiving portion 10 which has a rigid lower jaw 11 attached thereto and also has a hinged top jaw 12 attached thereto. These jaws have opposed gripping surfaces in longitudinal grooves 26 and 27 which squeeze the catheter against the cannula. A removable rigid band 13 can be used to hold the jaws in gripping relationship during venipuncture. After the venipuncture, the hub is opened up as shown in FIG. 4 and is pulled back over the catheter with the hollow adapter 15 passing through the large catheter opening 24 in sheath receiving portion 10. The rigid band 13 can likewise be pulled rearwardly off over the catheter.

The second embodiment (FIGS. 7—9) has a base wall 30 with a pair or upstanding arms 31 and 32 on opposite sides of catheter 2. A lid 33 pivotally connects to the upstanding arms through pivot shafts 34 and 35 which fit into pivot pockets in these arms. Numeral 36 denotes the pivot pocket in arm 31, and there is a like pivot pocket in arm 32. This lid 33 swings longitudinal towards base wall 30 and a portion 37 tightly clamps the catheter and cannula against base wall 30. Holding the lid 33 and base wall 30 in this gripping relationship is a cam member 46, which cam member 46, 41 and 42 that removably fit into pivot pockets in a second set
of upstanding arms 38 and 39. Numeral 43 denotes the pivot pocket in arm 38 and 39 has a like pivot pocket. To open this embodiment of my hub the operator pulls up on a handle of cam member 40 to release the cam pressure on lid 33. After removing cam member 40 he then swings open lid 33 and pulls pivot shafts 34 and 35 out of the pivot pockets in upstanding arms 31 and 32. This lets the base wall 30 and upstanding arm portions of the hub slide out from under the catheter.

Another feature of this second embodiment is the way an outer flexible sheath 8 is held to the hub. On each side of catheter 2 are cavities 44 and 45 in base wall 30 which can extend completely through the base wall if desired. Cooperating with these cavities are lugs 46 and 47 on lid 33 which push the flexible outer sheath 8 into the cavities where it is retained. When the lid is removed this release catheter 2, it simultaneously releases outer sheath 8.

The third and final hub embodiment (FIGS. 10-12) has a base wall 50 also with upstanding arms 53 and 54. Here, however, the lid 55 is hingedly connected to one arm 53 and transversely swings across the catheter to grip it to base wall 50. An opening 56 in lid 55 receives a catch means 57 on upstanding arm 54 to lock the lid against the catheter and cannula. As in the second embodiment, lugs 60 and 61 cooperate with cavities 58 and 59 to simultaneously grip the flexible outer sheath 8.

The three hub versions described above can be made of various materials. However, the first and third embodiments are preferably made of polypropylene plastic with an integral polypropylene hinge between the jaws of the first embodiment and between the lid and upstanding arm of the third embodiment.

Having explained the structure of the various embodiments of my invention, we now turn to a brief description of how it is used. First, the operator takes the intravenous catheter apparatus as shown in FIG. 1 and makes the venipuncture. Next, he pulls off band 13 (or removes cam member 40) or releases catch 57 and opens up the hub to release pressure on cannula 1. Then he pulls out wire 5 which retracts cannula 1 and pulls off the cannula housing. Preferably, wire 5 is pulled back by grasping handle 6 through flexible outer sheath 8. However, if desired, a perforation 14 can be provided so a rear portion of flexible outer sheath 8 can be removed to get a good grip on handle 6. After the cannula 1 has been retracted, he pushes flexible outer sheath 8 and hub 9 from catheter 2. He can remove them separately by pulling flexible outer sheath 8 off hub 9 or he can remove them while the sheath and hub are still connected together. Finally, all that remains is an elongated flexible catheter in the patient's vein. There is no rigid annulus that can cause injury to him.

In the foregoing specification, I have described my invention using certain specific embodiments. It is understood that persons skilled in the art can make modifications to these embodiments without departing from the spirit and scope of this invention.

I claim:

1. Intravenous catheter apparatus comprising:
   a rigid puncturing cannula;
   a flexible catheter telescoped on an outside surface of said cannula;
   a removable hub circumnosed about said catheter and including a separable, displaceable, mechanical gripping means on said hub for urging the hub and catheter to a fixed relation to at least a portion of the cannula and circumferentially squeezing the catheter against the cannula to continuously prevent relative longitudinal movement therebetween, said hub having opposed separable gripping surfaces displacable from each other upon displacement of the mechanical gripping means and release of the circumferential squeezing by said mechanical gripping means to permit relative longitudinal separation of the catheter and cannula; and a flexible sheath attached to said hub for protecting the catheter portion which extends rearwardly beyond said hub.

2. Intravenous catheter apparatus as set forth in claim 1, wherein the hub includes a pair of hinged jaws having gripping surfaces in opposed longitudinal grooves in the jaws.

3. Intravenous catheter apparatus as set forth in claim 2, wherein the hub is of polypropylene and has an integral polypropylene hinge between the jaws.

4. Intravenous catheter apparatus as set forth in claim 1 wherein the hub includes a sheath-receiving portion having an opening extending therethrough for passage of the catheter, said sheath-receiving portion having a bottom jaw of the hub rigidly attached thereto and said hub having a top jaw hingedly attached thereto on a transverse, chordally-disposed integral hinge portion, said top and bottom jaws having gripping surfaces in longitudinal opposed grooves in the jaws for transmitting said circumferential squeezing and integrating simultaneous movement of said cannula and catheter when a venipuncture is being made.

5. Intravenous catheter apparatus as set forth in claim 4 wherein said separate, removable, mechanical gripping means comprises a rigid band releasably surrounding the jaws and normally radially urging them in gripping relationship with said catheter, said rigid band being removable from the jaws and the jaws can swing open for removal of the hub from the catheter.

6. Intravenous catheter apparatus as set forth in claim 1 wherein the hub includes a base wall with upstanding arms on opposite sides of said catheter, a lid pivotally connected to these arms and adapted to swing longitudinally along the catheter toward said base wall to grip said catheter between said lid and said base wall.

7. Intravenous catheter apparatus as set forth in claim 6 wherein the base wall has a second set of upstanding arms on opposite sides of said catheter, and said means is a cam member removably connected to said second set of upstanding arms, said cam member forcing said lid to squeeze said catheter against said base wall.

8. Intravenous catheter apparatus as set forth in claim 6 wherein the flexible sheath is gripped between said lid and base wall.

9. Intravenous catheter apparatus as set forth in claim 8 wherein the flexible sheath is gripped on opposite sides of the catheter by a lug and cavity construction in the lid and base wall.

10. Intravenous catheter apparatus as set forth in claim 1 wherein the hub includes a base wall, a pair of upstanding arms on opposite sides of the catheter, a lid pivotally connected to one arm and adapted to swing transversely across said catheter and grip said catheter between the lid and said base wall, and releasable catch means on the other arm to hold said lid in gripping relationship with said catheter.

11. Intravenous catheter apparatus as set forth in claim 10 wherein the flexible sheath is gripped between said lid and base wall.

12. Intravenous catheter apparatus as set forth in claim 11 wherein the flexible sheath is gripped on opposite sides of the catheter by a lug and cavity construction in the lid and base wall.

13. Intravenous catheter apparatus as set forth in claim 1 wherein the catheter is substantially longer than the cannula and wherein the apparatus has a flexible wire connected at one end to the cannula, which wire extends outwardly through a bore of the catheter for pulling the cannula out of the catheter.

14. Intravenous catheter apparatus as set forth in claim 1 wherein the flexible sheath is removable from the hub.

15. Intravenous catheter apparatus as set forth in claim 1 wherein the catheter has a hollow adapter on an end of the catheter within said flexible sheath, and wherein the apparatus includes a removable closure for said hollow adapter.

16. Intravenous catheter apparatus as set forth in claim 1 wherein said catheter is substantially longer than said cannula and a pointed end of said cannula of said cannula protrudes from a forward end of the catheter; a flexible wire with one
end attached to the cannula and extending through a bore of the catheter for retracting said cannula rearwardly through said catheter, said catheter-wire-cannula combination being rigid along the cannula length and flexible rearward of said cannula.

17. Intravenous catheter apparatus as set forth in claim 16 wherein the hub and flexible sheath are removable from the combination.

18. Intravenous catheter apparatus as set forth in claim 16 wherein the wire has a handle means attached to an end of the wire opposite the wire's cannula attached end.

19. Intravenous catheter apparatus as set forth in claim 16 wherein the catheter has a hollow adapter on an end of the catheter with said flexible sheath and the apparatus includes a removable closure for said hollow adapter.

20. Intravenous catheter apparatus comprising: a rigid puncturing cannula; a flexible catheter telescoped on an outside surface of the puncturing cannula, said catheter being substantially longer than said cannula and having a pointed end of said cannula protruding from a forward end of the catheter; a flexible wire with one end attached to the cannula and extending through a bore of the cannula for retracting said cannula through said catheter, said catheter-wire-cannula combination being rigid along the length of said cannula but flexible rearward of said cannula; a grasping hub connected to the rigid portion of the catheter-wire-cannula combination; a flexible inner sheath connected between the catheter and the wire and adapted to encase said wire as this wire is pulled out of the catheter's bore; and a flexible outer sheath encasing the inner sheath and the flexible portion of the catheter-wire-cannula combination.

21. Intravenous catheter apparatus as set forth in claim 20 wherein the apparatus has a cannula housing removably attached to a rear of the catheter.

22. Intravenous catheter apparatus as set forth in claim 21 wherein the cannula housing is encased in the inner flexible sheath.

23. Intravenous catheter apparatus as set forth in claim 21 wherein the cannula housing has a mouth closed off by a closure with said wire passing through an opening in said closure, said opening being sufficiently small so the closure can act as a stop against a shoulder at a rear end of the cannula caused by the cannula having a larger outside diameter than said wire.

24. Intravenous catheter apparatus as set forth in claim 23 wherein the closure is a resilient diaphragm through which the wire is threaded.