ABSTRACT: A blood transfer device for venipuncture and the like is provided having a double-pointed cannula, a main chamber for loading and reloading cartridges, and a pilot chamber separated from the main chamber by a resilient collapsible cannula sheath. When the device is used and the cannula is correctly positioned as for venipuncture, the blood enters the cannula and flows into the pilot chamber through certain aperture means between the cannula and the pilot chamber enabling the operator to confirm visually by the presence of a substantial sample that the placement is correct. One injection serves for the loading and filling of several cartridges, as desired, without spilling of blood between loadings and with minimum risk of exposure to contamination, etc.
BLOOD TRANSFER DEVICE
SUMMARY AND DETAILED DESCRIPTION

This invention relates to blood transfer devices and more particularly to blood transfer devices for veni-puncture and the like assuring the correct placement of the cannula within the vein.

Heretofore, the devices commonly used for veni-puncture, blood withdrawal, parenteral administration, etc. have generally suffered from the disadvantage that means were lacking for determining readily whether or not the cannula end was correctly placed in the vein. For blood withdrawal purposes, for example, where the cannula is incorrectly placed, an insufficient blood sample is obtained or the site of injection becomes traumatized through misplacement, misadventure, etc. On the other hand, in devices which incorporate features for the detection of venous blood prior to the main sample, the construction has been unduly complicated or difficult to manipulate or the volume of fluid transferred with each injection has been unduly restricted.

It is therefore an object of the present invention to provide simple, inexpensive means for detecting the correct placement of blood transfer devices for intravenous injection. It is also an object of the invention to provide blood transfer devices having a main chamber and a separate pilot chamber—the latter chamber being useful for initial collection of the blood sample to determine visually whether or not the device is correctly oriented for access to the vein.

It is a further object of the invention to provide blood transfer devices which can be used either for the withdrawal of blood samples or for the administration of drugs, medicaments and the like, or for both in a single injection and in any desired volume.

Other objects, features and advantages will be apparent from the specification which follows, in conjunction with the accompanying drawings in which:

FIG. 1 is a side view of a preferred blood transfer device of the invention, partly cut away to show details in the construction of the cannula and associated sheath means;

FIG. 2 is a cross section of the preferred device shown in FIG. 1 taken on a line 2-2 designated in FIG. 3;

FIG. 3 is an end view taken on line 3-3 of FIG. 1 of a blood transfer device of the invention;

FIG. 4 is an enlarged partial section of another preferred embodiment of the invention showing the cannula piercing the sheath means and cartridge stopper and also illustrating the collapsed position of the sheath means;

FIG. 5 is a sectional view of the cannula and sheath means taken on line 5-5 of FIG. 1, and FIG. 6 is a similar view showing channels 19 between the cannula and collar 21.

Referring to FIGS. 1 and 2 of the drawing, the blood transfer device includes a holder 10 defining a main chamber 11 and a pilot chamber 12. The pilot chamber is defined by a hub 13 and the neck portion 14. The hub 13 serves as a mounting for a cannula 15. The opposite end of the holder has an open end 16 for receiving cartridges containing drugs, vaccines or the like for administration under pressure or cartridges evacuated for blood collection purposes. The cartridge 23 (partly shown in FIG. 4) can take any of a number of various forms known in the art. Surrounding the opening are the flanges 17 providing means for conveniently gripping the holder 10.

The cannula 15 has an outer end 18a for injection and an inner end 18b. It also includes aperture means 19 located generally midway between the ends of the cannula in communication with the pilot chamber 12. Surrounding the inner end 18b of the cannula 15 is sheath means 20 at the base of which is a supporting collar 21.

The sheath means 20 with its collar 21 serves as a fluid-impermeable seal between the pilot chamber 12 and the main chamber 11. It is resilient and flexible, particularly in the sheath portion; it is also resealable or self-sealing when punctured. The term "sheath means" is sometimes used herein in a general sense to include both elements 20 and 21 and will be so understood. The sheath means operates according to the invention in two positions: In one position, it extends into the unloaded main chamber 11 as shown in FIGS. 1 and 2 where it surrounds the cannula end 18b and walls off the main chamber from the pilot chamber 12. In the other position, the sheath means, when contacted in an axial direction by a cartridge 23 (e.g., a cartridge of the type illustrated in U.S. Pat. No. 3,366,103) being loaded into the chamber, is forced against and pierced by the pointed inner end 18b of the cannula, and is collapsed as illustrated in FIG. 4 with the result that the lumen of the cannula is in open communication with the interior of the cartridge. In turn, when the cartridge is withdrawn, the sheath spontaneously reseals itself and flexes back to its original position.

As shown in FIG. 3, the holder in a preferred form is generally cylindrical with the cannula 15, hub 13 and neck 14 in axial alignment along the central axis of the holder.

The embodiment shown in collapsed form in FIG. 4 is a preferred construction where instead of aperture means intermediate the outer and inner ends of the cannula there is provided an annular open zone 19 within the body of the shelling device having means 20 surrounding the cannula whereby blood entering the cannula is in open communication with the pilot chamber 12 and is free to move and distribute itself within the confines of the pilot chamber. Prior to collapsing, the sheath means of FIG. 4 assumes the position free of end 18b, as in the unexcelled position shown in FIG. 2. In the embodiments of FIGS. 1, 2 and 4 the wall portions of the hub 13, neck 14 and/or sheath means 20 are conveniently made of transparent material so that blood contained in the pilot chamber can be readily observed. By this means the device can be used for veni-puncture and the like by inserting the outer end 18a into the vein so that the blood enters and passes through the cannula into the pilot chamber 12 by way of the aperture means 19 as seen in FIGS. 1 and 2 or the aperture means 19 within the sheath means 20, as seen in FIG. 4. In this case if the cannula 15 is correctly positioned within the vein the venous pressure serves to pump the blood free into the pilot chamber substantially filling the same so that a distinct and sharp visual red coloration may be readily observed. On the other hand, where the placement of the cannula 15 is incorrect the supply of venous blood, if any, reaching the pilot chamber is essentially null, thereby giving direct visual indication of an improper placement of the cannula. The sheath means 20 in any case serves to prevent the entry of blood into the main chamber 11. Thus, when it is desired for purposes of the invention to take a blood sample, the injection is made to provide visual indication in the pilot chamber 12 of the correct placement of the cannula.

A vacuum cartridge is then inserted into the main chamber 11 through the open end 16 until its stopper contacts sheath means 20 and collapses the same upon the inner end 18b of the cannula 15, causing the sheath means to be pierced so that the inner end 18b of the cannula reaches the evacuated zone. The resulting high-pressure differential causes blood to flow from the vein through the cannula 15 into the cartridge. The procedure is continued until the cartridge is sufficiently full for sampling purposes. The cartridge is then withdrawn from the chamber 11. As a consequence of withdrawal and because the sheath means 20 is resilient, flexible and resealable, the sheath means flexes back into the position illustrated so that the cannula 15 is sealed off against further blood flow into the main chamber 11. At this point, the cannula can be withdrawn from the vein or, if desired, fresh cartridge can be loaded and filled without interruption and without the need for making a new injection for the filling of each tube. Substantially the same procedure using pressure cartridges instead of vacuum cartridges can be followed. Thus, when the correct placement of the cannula 15 is obtained as indicated by the sample supply of venous blood in the pilot chamber 12 the medicament cartridge can then be loaded into the chamber 11, whereupon the positive pressure present in the cartridge
serves to cause the medicament contents to move through the cannula into the vein until the pressure is equalized.

The aperture means 19 can take any of various forms including an opening between the ends of the cannula (FIG. 1), an annular open zone of uniform section separating the collar and sheath from the cannula (FIG. 4), and channels 19 (FIG. 6) at the interface between the collar and cannula. Other equivalent forms will be suitable.

The makeup of the various components employed in the blood transfer devices of the invention can be of any conventional material. Thus, the cannula will ordinarily be of high grade surgical stainless steel. The holder 10 can be made of glass, plastic or other suitable inert material, preferably transparent and readily sterilizable. The sheath means 20 and collar 21, suitably made of gum rubber, elastomeric plastic or the like, should be impervious to fluids and resilient so as to provide the required seal between the pilot chamber 12 and main chamber 11. In particular, the sheath means 20 should be sufficiently resilient to be pierced and collapsed by the insertion of a cartridge in chamber 11 and yet to flex back and reseal in its original position covering the inner end of the cannula 180 when the cartridge is withdrawn from the chamber. As an optional feature shown in FIG. 4, the collar 21 can be made of a somewhat more rigid material and can be anchored into the neck 14 in seating relationship within the channel 22, secured if necessary by adhesive or other suitable means.

While the invention has been described in detail in the foregoing specification, it will be realized by those skilled in the art that considerable variation can be made in such detail without departing from the spirit of the invention.

I claim:

1. A blood transfer device comprising: a holder including a hub, a neck and an axially extending main chamber adapted to receive a cartridge; a cannula having piercing outer and inner ends; means for mounting the inner end of the cannula in axial alignment within the holder for piercing contact with a cartridge inserted in the holder; pierceable sheath means adapted in a first position to enclose the inner end of the cannula and sealingly prevent blood in the cannula from entering the main chamber and further adapted in a second position with a cartridge inserted in said piercing contact in the holder to be pierced by the inner end of the cannula and to expose the same for fluid transfer with respect to the cartridge, the sheath means being fixedly mounted by collar means within the neck and being resilient such that upon withdrawal of a cartridge from the main chamber the sheath means flexes back to said first position and reseals;

a pilot chamber defined by the hub, neck and collar means, the pilot chamber being separate from the main chamber and including light-transmissive wall means for viewing the presence of blood collected in the pilot chamber; and aperture means including an opening in the cannula wall between the ends of the cannula, the opening being in direct communication with the pilot chamber whereby, prior to insertion of a cartridge, blood under tension entering the outer end of the cannula has direct access for distribution to the pilot chamber for visual observation.