CATHETER SYSTEM FACILITATING BLOOD FLASHBACK VISUALIZATION

BACKGROUND

[0001] Catheters are commonly used for a variety of infusion therapies. For example, catheters may be used for infusing fluids, such as normal saline solution, various medicaments, and total parenteral nutrition, into a patient. Catheters may also be used for withdrawing blood from the patient.

[0002] A common type of catheter is an over-the-needle peripheral intravenous catheter ("PIVC"). As its name implies, the over-the-needle PIVC may be mounted over an introducer needle having a sharp distal tip. The PIVC and the introducer needle may be assembled so that the distal tip of the introducer needle extends beyond the distal tip of the PIVC with the bevel of the needle facing up away from skin of the patient. The PIVC and the introducer needle are generally inserted at a shallow angle through the skin into vasculature of the patient.

[0003] In order to verify proper placement of the introducer needle and/or the PIVC in the blood vessel, a user generally confirms that there is flashback of blood within a catheter system that includes the PIVC. The user visualizes the flashback of blood within the catheter system to determine the introducer needle is within the vasculature. Once placement of the needle has been confirmed, the user may temporarily occlude flow in the vasculature and remove the introducer needle, leaving the PIVC in place for future blood withdrawal and/or fluid infusion. The PIVC assembly may be coupled with an extension set, which may allow coupling of an infusion or blood withdrawal device at a location removed from an insertion site of the PIVC.

[0004] The subject matter claimed herein is not limited to embodiments that solve any disadvantages or that operate only in environments such as those described above. Rather, this

background is only provided to illustrate one example technology area where some implementations described herein may be practiced.

SUMMARY

[0005] The present disclosure relates generally to vascular access systems and related devices and methods. In some embodiments, a catheter system may include a catheter assembly, which may include a catheter adapter. In some embodiments, the catheter adapter may include a distal end and a proximal end. In some embodiments, the catheter assembly may include a catheter extending distally from the distal end of the catheter adapter. In some embodiments, the catheter may include a distal end and a proximal end. In some embodiments, the catheter may include a peripheral intravenous catheter (PIVC), a peripherally-inserted central catheter, or a midline catheter.

[0006] In some embodiments, the catheter system may also include a needle assembly, which may include a needle hub. In some embodiments, the needle hub may include a distal end and a proximal end. In some embodiments, the needle assembly may include an introducer needle, which may include a distal end and a proximal end. In some embodiments, the proximal end of the introducer needle may be secured within the needle hub. In some embodiments, the distal end of the introducer needle be sharp and may extend beyond a distal end of the catheter.

[0007] In some embodiments, the catheter system may include a vent plug, which may include a distal end and a proximal end. In some embodiments, a distal end of the vent plug may include a male luer adapter, which may include a cannula and a collar surrounding the cannula. In some embodiments, the cannula may include a cavity to receive blood flowing proximally through the introducer needle. In some embodiments, a proximal end of the cavity may be formed by a wall

extending across the cannula and disposed within the needle hub. In some embodiments, the cannula may be inserted into proximal end of the needle hub.

[0008] In some embodiments, a bottom portion of the cavity may extend distal to the proximal end of the introducer needle. In some embodiments, a portion of the cannula distal to the wall may be semi-annular such that there is a gap oriented above the introducer needle to facilitate visualization of blood exiting the proximal end of the introducer needle by a user. In some embodiments, the wall may include a vent membrane, which may pass air but not blood.

[0009] In some embodiments, in response to insertion of the introducer needle into vasculature of a patient by the user, blood may flow proximally through the introducer needle and into the cavity. In some embodiments, in response to blood flowing proximally through the introducer needle, air may move proximally through the vent membrane and/or out of the catheter system via another suitable pathway. In some embodiments, the catheter system may facilitate visualization of the blood by the user. In some embodiments, in response to visualization of the blood by the user, the user may remove the needle assembly from the catheter assembly, which may remain positioned within the vasculature for future blood withdrawal and/or fluid infusion.

[0010] In some embodiments, the catheter system may include a cap coupled to the proximal end of the vent plug. In some embodiments, the wall may be spaced apart from a proximal end of the cap. In some embodiments, the vent plug may include an annular channel, which may extend from the wall to the proximal end of the cap. In some embodiments, the cap may include another male luer. In some embodiments, the other male luer may include another cannula and another collar surrounding the other cannula. In some embodiments, the proximal end of the cap may include the other cannula.

[0011] In some embodiments, a thickness of the needle hub may allow visualization of blood that has exited the proximal end of the introducer needle. In some embodiments, the needle hub may include an annular wall. In some embodiments, a top portion of the annular wall may include a pocket to reduce a thickness of the top portion of the annular wall. In some embodiments, a portion of the cannula distal to the wall is semi-annular such that there is a gap oriented above the introducer needle to facilitate visualization of blood exiting the proximal end of the introducer needle by the user.

[0012] It is to be understood that both the foregoing general description and the following detailed description are examples and explanatory and are not restrictive of the invention, as claimed. It should be understood that the various embodiments are not limited to the arrangements and instrumentality shown in the drawings. It should also be understood that the embodiments may be combined, or that other embodiments may be utilized and that structural changes, unless so claimed, may be made without departing from the scope of the various embodiments of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0013] Example embodiments will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0014] Figure 1 is a cross-sectional view of a portion of a prior art catheter system, according to some embodiments;

[0015] Figure 2A is an upper perspective view of an example catheter system, according to some embodiments;

[0016] Figure 2B is a cross-sectional view of a portion of the catheter system of Figure 2A, according to some embodiments;

[0017] Figure 2C is a transverse cross-sectional view of the catheter system of Figure 2A along the line 2C-2C of Figure 2A, according to some embodiments; and

[0018] Figure 3 is an upper perspective view of an example needle hub, according to some embodiments.

DESCRIPTION OF EMBODIMENTS

[0019] The term "proximal" will refer to the portion of a structure closer to a user, while the term "distal" refers to the portion further from the user. Referring now to Figure 1, a portion of a prior art catheter system 10 is illustrated. The prior art catheter system 10 includes a catheter assembly 12. The catheter assembly 12 includes a catheter adapter 14. The catheter adapter 14 includes a proximal end 16. The prior art catheter system 10 includes a needle assembly 18, which may include a needle hub 20. The needle assembly 18 includes an introducer needle 22. The introducer needle 22 includes a proximal end 24 secured within the needle hub 20.

[0020] The prior art catheter system 10 includes a vent plug 26, which includes a distal end 28 and a proximal end 30. The distal end 28 of the vent plug 26 includes a male luer adapter, which includes a cannula 32 and a collar 34 surrounding the cannula 32. The cannula 32 may include a cavity 36 to receive blood flowing proximally through the introducer needle 22. A proximal end of the cavity 36 is formed by a wall 37, which is disposed outside the needle hub 20. In some embodiments, the cannula 32 is inserted into a proximal end 38 of the needle hub 20.

[0021] Referring now to Figures 2A-2B, in some embodiments, a catheter system 40 may include a catheter assembly 42, which may include a catheter adapter 44. In some embodiments,

the catheter adapter 44 may include a distal end 46 and a proximal end 48. In some embodiments, the catheter adapter 44 may include a port disposed between the distal end 46 and the proximal end 48. In some embodiments, the port may be closed with a cap 45, as illustrated, for example, in Figure 2A.

[0022] In some embodiments, the catheter assembly 42 may include a catheter 50 extending distally from the distal end 46 of the catheter adapter 44. In some embodiments, the catheter 50 may include a distal end 52 and a proximal end. In some embodiments, the catheter 50 may include a peripheral intravenous catheter (PIVC), a peripherally-inserted central catheter, or a midline catheter. In some embodiments, the catheter system 40 may include a BD VENFLON™ Pro Safety catheter system available from Becton, Dickinson & Company of Franklin Lakes, New Jersey, or another suitable catheter system.

[0023] In some embodiments, the catheter system 40 may also include a needle assembly 56, which may include a needle hub 58. In some embodiments, the needle hub 58 may include a distal end 60 and a proximal end 62. In some embodiments, the needle assembly 56 may include an introducer needle 64, which may include a distal end 66 and a proximal end 68. In some embodiments, the proximal end 68 of the introducer needle 64 may be secured within the needle hub 58. In some embodiments, the distal end 66 of the introducer needle 64 be sharp and may extend beyond the distal end 52 of the catheter 50. In some embodiments, a thickness of a wall of the introducer needle 64 may be less than a thickness of a wall of the introducer needle 22 of the prior art catheter system 10, which may facilitate rapid flow of blood proximally through the introducer needle 64 and visualization within the cavity 78

[0024] In some embodiments, the catheter system 40 may include a vent plug 72, which may include a distal end 74 and a proximal end 76. In some embodiments, a distal end 74 of the vent

plug 72 may include a male luer adapter, which may include a cannula 77 and a collar 79 surrounding the cannula 77. In some embodiments, the cannula 77 may include a cavity 78 to receive blood flowing proximally through the introducer needle 64. In some embodiments, a proximal end of the cavity 78 may be formed by a wall 80 extending across the cannula 77 and disposed within the needle hub 58. In some embodiments, the cannula 77 may be inserted into proximal end 62 of the needle hub 58.

[0025] In some embodiments, a length of the cavity 78 aligned with a longitudinal axis of the introducer needle 64 may be less than a length of the cavity 36 of the needle hub 20 of the prior art catheter system 10. Additionally or alternatively, in some embodiments, a depth of the cavity 78 perpendicular to a longitudinal axis of the introducer needle 64 may be less than a depth of the cavity 36 of the needle hub 20 of the prior art catheter system 10. Thus, in some embodiments, the blood flowing through the introducer needle 64 from the patient may be visualized more quickly in the catheter system 40.

[0026] In some embodiments, a portion 82 of the cannula 77 distal to the wall 80 may be semi-annular such that there is a gap 84 oriented above the introducer needle 64 to facilitate visualization of blood exiting the proximal end 68 of the introducer needle 64 by a user. In some embodiments, the portion 82 of the cannula 77 may be disposed towards a bottom of the vent plug 72 and the catheter system 40. As used in the present disclosure, a top of a particular structure may face away from skin of a patient, while a bottom of a particular structure may face toward from the skin of the patient. In some embodiments, the portion 82 of the cannula 77 may extend distal to the proximal end 68 of the introducer needle 64.

[0027] In some embodiments, the wall 80 may include a vent membrane 86, which may pass air but not blood. In some embodiments, in response to insertion of the introducer needle 64 into

vasculature of a patient by the user, blood may flow proximally through the introducer needle 64 and into the cavity 78. In some embodiments, in response to blood flowing proximally through the introducer needle 64 and the cap 88 being removed, air may move proximally through the vent membrane 86 and out of the catheter system 40. In some embodiments, the catheter system 40 may facilitate visualization of the blood by the user. In some embodiments, in response to visualization of the blood by the user, the user may remove the needle assembly 56 from the catheter assembly 42, which may remain positioned within the vasculature for future blood withdrawal and/or fluid infusion.

[0028] In some embodiments, the catheter system 40 may include a cap 88 coupled to the proximal end 76 of the vent plug 72. In some embodiments, the wall 80 may be spaced apart from a proximal end 90 of the cap 88. In some embodiments, the vent plug 72 may include an annular channel 92, which may extend from the wall 80 to the proximal end 90 of the cap 88. In some embodiments, the cap 88 may include another male luer. In some embodiments, the other male luer may include another cannula 94 and surrounding the other cannula 94. In some embodiments, the proximal end 90 of the cap 88 may include the other cannula 94.

[0029] In some embodiments, a thickness of the needle hub 58 may allow visualization of blood that has exited the proximal end of the introducer needle 64. In some embodiments, the thickness of the needle hub 58 may be less than a thickness of the needle hub 20 of the prior art catheter system 10.

[0030] Referring now to Figure 3, in some embodiments, the needle hub 58 may include an annular wall 98. In some embodiments, a top portion of the annular wall 98 may include a pocket 100 to reduce a thickness of the top portion of the annular wall 98, which may facilitate visualization by the user of blood travelling out the proximal end 68 of the introducer needle 64.

In some embodiments, the pocket 100 may include a groove or a portion of the annular wall 98 that is cut away or thinned such that the user can see blood within the needle assembly 56 through the annular wall 98. The pocket 100 is not an opening, so blood cannot flow through the pocket 100. In some embodiments, the needle hub 58 may include a push tab 102, which may be generally aligned with the pocket 100.

[0031] All examples and conditional language recited herein are intended for pedagogical objects to aid the reader in understanding the invention and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Although embodiments of the present inventions have been described in detail, it should be understood that the various changes, substitutions, and alterations could be made hereto without departing from the spirit and scope of the invention.

CLAIMS

1. A catheter system, comprising:

a catheter assembly, comprising:

a catheter adapter, comprising a distal end and a proximal end;

a catheter extending distally from the distal end of the catheter adapter; and

a needle assembly, comprising:

a needle hub, comprising a distal end and a proximal end;

an introducer needle, comprising a distal end and a proximal end, wherein the proximal end of the introducer needle is secured within the needle hub, wherein the distal end of the introducer needle extends beyond a distal end of the catheter; and

a vent plug, comprising a distal end and a proximal end, wherein the distal end of the vent plug comprises a male luer adapter, wherein the male luer adapter comprises a cannula and a collar surrounding the cannula, wherein the cannula comprises a cavity to receive blood flowing proximally through the introducer needle, wherein a proximal end of the cavity is formed by a wall extending across the cannula and disposed within the needle hub, wherein the cannula is inserted into proximal end of the needle hub.

2. The catheter system of claim 1, wherein a bottom portion of the cavity extends distal to the proximal end of the introducer needle.

3. The catheter system of claim 2, wherein a portion of the cannula distal to the wall is semi-annular such that there is a gap oriented above the introducer needle to facilitate visualization of blood exiting the proximal end of the introducer needle.

4. The catheter system of claim 1, wherein the wall comprises a vent membrane.

5. The catheter system of claim 1, wherein the catheter system further comprises a cap coupled to the proximal end of the vent plug, wherein the wall is spaced apart from a proximal end of the cap.

6. The catheter system of claim 5, wherein the vent plug comprises an annular channel extending from the wall to the proximal end of the cap.

7. The catheter system of claim 6, wherein the cap comprises another male luer, wherein the other male luer comprises another cannula and another collar surrounding the other cannula, wherein the proximal end of the cap comprises the other cannula.

8. The catheter system of claim 1, wherein a thickness of the needle hub allows visualization of blood that has exited the proximal end of the introducer needle.

9. The catheter system of claim 1, wherein the needle hub comprises an annular wall, wherein a top portion of the annular wall comprises a pocket to reduce a thickness of the top portion of the annular wall.

10. The catheter system of claim 9, wherein a portion of the cannula distal to the wall is semi-annular such that there is a gap oriented above the introducer needle to facilitate visualization of blood exiting the proximal end of the introducer needle.