

PERIPHERAL INTRAVENOUS CATHETER ASSEMBLY HAVING AN EXTENSION SET

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 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 clinician generally confirms that there is “flashback” of blood in a flashback chamber of a PIVC assembly. Once placement of the needle has been confirmed, the clinician 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 devices, systems, and methods for facilitating delivery of an instrument and/or fluid through a catheter, which may include a peripheral intravenous catheter (PIVC). The devices, systems, and methods of the present disclosure may also be used for blood withdrawal, according to some embodiments. In some embodiments, the instrument may include an additional catheter for fluid infusion or blood draw, a guidewire, a probe with a sensor, or a light tube for disinfection.

[0006] In some embodiments, a catheter assembly may include a catheter adapter. In some embodiments, the catheter adapter may include a proximal end, a distal end, a lumen extending through the proximal end and the distal end, and a side port. In some embodiments, the catheter assembly may include a catheter, such as, for example, a PIVC, which may extend distally from the catheter adapter.

[0007] In some embodiments, the catheter assembly may include a first extension tube, which may include a proximal end and a distal end. In some embodiments, the first extension tube may extend from the side port. In some embodiments, the catheter assembly may include a first connector coupled to the proximal end of the first extension tube. In some embodiments, the first connector may include a first port and/or a second port.

[0008] In some embodiments, the catheter assembly may include a second extension tube, which may include a proximal end and a distal end. In some embodiments, the distal end of the second extension tube may be coupled to the first port. In some embodiments, the second extension

tube may be longer than the first extension tube. In some embodiments, the catheter assembly may include a second connector coupled to the proximal end of the second extension tube. In some embodiments, a clamp may be disposed on the first extension tube and/or the second extension tube.

[0009] In some embodiments, the first port may direct the second extension tube distally. In some embodiments, the first port may be disposed at an angle of less than 90° with respect to the second port. In some embodiments, the second port may be aligned with a longitudinal axis of the first connector. In some embodiments, the first port may be disposed at an angle between 45° and 90° with respect to the second port. In some embodiments, the first port may be perpendicular to the second port.

[0010] In some embodiments, the first connector may include a Y-shape or a T-shape. In some embodiments, the first port and the second port may form arms of the Y-shape or the T-shape. In some embodiments, the first connector may include a third port, which may form a trunk of the Y-shape or the T-shape. In some embodiments, the third port may extend proximally, and the first port and the second port may extend distally. In some embodiments, the first port may direct the second extension tube across a longitudinal axis of the catheter adapter.

[0011] In some embodiments, the first connector may not include any catch points for fluid or the instrument moving through the first connector in a distal direction to enter the catheter adapter. In some embodiments, the second connector may not include any catch points for fluid or the instrument moving through the second connector in the distal direction.

[0012] In some embodiments, the first connector may be selectively coupled to the first extension tube. Alternatively, in some embodiments, the first connector may be permanently or non-removably coupled to the first extension tube. In some embodiments, the proximal end of the

first extension tube may be fixed within the first connector. In some embodiments, the first connector may be coupled to the proximal end of the first extension tube via a snap fit.

[0013] In some embodiments, the catheter adapter may include multiple side ports. In some embodiments, the side port may be a first side port, and the catheter adapter may include a second side port. In some embodiments, the second side port may oppose the first side port or extend from a top of the catheter adapter. In some embodiments, the catheter assembly may include one or more of the following: a third extension tube, a third connector, a fourth extension tube, and a fourth connector.

[0014] In some embodiments, the third extension tube may include a proximal end and a distal end. In some embodiments, the third extension tube may extend from the second side port. In some embodiments, the third connector may be coupled to the proximal end of the third extension tube. In some embodiments, the third connector may include a third port and a fourth port. In some embodiments, the fourth extension tube may include a proximal end and a distal end.

[0015] In some embodiments, the distal end of the fourth extension tube may be coupled to the third port of the third connector. In some embodiments, the fourth extension tube may be longer than the third extension tube. In some embodiments, the fourth connector may be coupled to the proximal end of the fourth extension tube. Thus, in some embodiments, the catheter assembly may include multiple extension sets.

[0016] In some embodiments, the third extension tube may extend from the distal end of the catheter adapter. In some embodiments, the distal end of the catheter adapter may include a needle port and/or a distal port from which the third extension tube extends. In some embodiments, the needle port and the distal port may be disposed vertically with respect to each other. In some

embodiments, the needle port and the distal port may be disposed horizontally with respect to each other.

[0017] It is to be understood that both the foregoing general description and the following detailed description are exemplary 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

[0018] Example embodiments will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0019] Figure 1A is an upper perspective view of an example prior art catheter assembly;

[0020] Figure 1B is an upper perspective view of a prior art needle assembly removed from the prior art catheter assembly;

[0021] Figure 1C is a cross-sectional view of an example prior art connector;

[0022] Figure 2A is an upper perspective view of a catheter assembly having an example Y-shaped connector, according to some embodiments;

[0023] Figure 2B is an upper perspective view of the catheter assembly of Figure 2A having an example T-shaped connector, according to some embodiments;

[0024] Figure 2C is an upper perspective view of the catheter assembly of Figure 2A having an example inverted Y-shaped connector, according to some embodiments;

[0025] Figure 3A is a cross-sectional view of an example connector, according to some embodiments;

[0026] Figure 3B is a cross-sectional view of another example connector, according to some embodiments;

[0027] Figure 4A is a cross-sectional view of an example Y-shaped connector, according to some embodiments;

[0028] Figure 4B is a cross-sectional view of an example T-shaped connector, according to some embodiments;

[0029] Figure 5 is an upper perspective view of another catheter assembly, according to some embodiments;

[0030] Figure 6A is an upper perspective view of another example catheter adapter, according to some embodiments;

[0031] Figure 6B is an upper perspective view of another example catheter adapter, according to some embodiments;

[0032] Figure 6C is a proximal end view of another example catheter adapter, according to some embodiments;

[0033] Figure 7A is a cross-sectional view of another example Y-shaped connector, according to some embodiments; and

[0034] Figure 7B is a cross-sectional view of the Y-shaped connector of Figure 7A coupled to an example extension tube via a snap fit.

DESCRIPTION OF EMBODIMENTS

[0035] Referring now to Figures 1A-1B, a prior art catheter assembly 10 is illustrated. The prior art catheter assembly 10 includes a catheter adapter 12 and a catheter 14 extending distally from the catheter adapter 12. The prior art catheter assembly 10 also includes an extension set, which includes an extension tube 16 and a connector 17. The extension tube 16 extends from a side port 18 of the catheter adapter 12.

[0036] The prior art catheter assembly 10 further includes a needle hub 20 and an introducer needle 22. When the needle hub 20 is coupled to the catheter adapter 12, the introducer needle 22 extends through the catheter adapter 12 and the catheter 14 and beyond a distal end of the catheter 14 to aid in insertion of the catheter 14 into vasculature of a patient.

[0037] As illustrated in Figure 1A, the extension tube 16 may curve around a proximal end of the catheter adapter 12 and/or the needle hub 20. In these and other instances, the extension tube 16 may be in the way of a hand of a clinician as the clinician attempts to insert the catheter 14 into the vasculature of the patient. In some instances, the clinician may grip the extension set in his or her fingers to control the extension set during insertion of the catheter 14 into the vasculature of a patient and/or to prevent the extension set from contacting an insertion site of the catheter 14 once the catheter 14 is inserted into the vasculature of the patient. Gripping the extension set in such a way during insertion of the catheter 14 may be complicated and require physical coordination of the clinician. Furthermore, in some instances, the extension tube 16 and/or the connector 17 may interfere with visualization of blood flashback by the clinician.

[0038] Referring now to Figure 1C, the connector 17 of the prior art catheter assembly 10 includes one or more catch points 24, which may interfere with fluid or a probe moving in a distal direction through the connector 17. In some instances, the catch points 24 may include surfaces generally perpendicular to a longitudinal axis 26 or flow path of the connector 17.

[0039] Referring now to Figures 2A-2B, in some embodiments, a catheter assembly 30 may include a catheter adapter 32, which may include a proximal end 34, a distal end 36, a lumen extending through the proximal end 34 and the distal end 36, and a side port 38. In some embodiments, the catheter assembly 30 may include a catheter 40, such as, for example, a PIVC, extending distally from the catheter adapter 32. In some embodiments, the catheter assembly 30 may include one or more elements of the prior art catheter assembly 10.

[0040] In some embodiments, the catheter assembly 30 may include a first extension tube 42, which may include a proximal end 44 and a distal end 46. In some embodiments, the first extension tube 42 may extend from the side port 38. In some embodiments, the catheter assembly 30 may include a first connector 48 coupled to the proximal end 44 of the first extension tube 42. In some embodiments, the first connector 48 may include a first port 50 and a second port 52. In some embodiments, the first connector 48 and/or the second port 52 may be disposed in proximity to the catheter adapter 32 and the catheter 40 to improve access for an instrument, as well as to allow higher viscosity or speed-critical fluid injections and improved flushing. In some embodiments, the instrument may include an additional catheter for fluid infusion or blood draw, a guidewire, a probe with a sensor, or a light tube for disinfection. In some embodiments, a length of the first extension tube 42 may be about 12 millimeters. In some embodiments, the length of the first extension tube 42 may be between about 11 and 13 millimeters. In some embodiments, the length of the first extension tube 42 may be between about 10 and 14 millimeters. In some embodiments, the length of the first extension tube 42 may be greater than 12 millimeters. In some embodiments, the length of the first extension tube 42 may be less than 12 millimeters. The length of the first extension tube 42 may vary, according to some embodiments.

[0041] In some embodiments, the catheter assembly 30 may include a second extension tube 54, which may include a proximal end 56 and a distal end 58. In some embodiments, the distal end 58 of the second extension tube 54 may be coupled to the first port 50. In some embodiments, the second extension tube 54 may be longer than the first extension tube 42. In some embodiments, the catheter assembly 30 may include a second connector 60, which may be coupled to the proximal end 56 of the second extension tube 54. In some embodiments, the second port 52 may be aligned with a longitudinal axis of the first connector 48. In some embodiments, a clamp 62, such as, for example, a slide clamp or a pinch clamp, may be disposed on the first extension tube 42 and/or the second extension tube 54.

[0042] In some embodiments, the first port 50 may direct the second extension tube 54 distally. In some embodiments, the second extension tube 54 may be disposed away from an area behind the catheter adapter 32 and away from a longitudinal axis 55 of the catheter adapter 32 to prevent interference of the second extension tube 54 with the hand of the clinician as the clinician grips the catheter adapter 32 to insert the catheter 40 into the vasculature of the patient.

[0043] In some embodiments, the first port 50 may be disposed at an angle of less than 90° with respect to the second port 52, as illustrated, for example, in Figure 2A. In further detail, in some embodiments, the first port 50 may be disposed at an angle between 45° and 90° with respect to the second port 52. In some embodiments, the first port 50 may be perpendicular to the second port 52, as illustrated, for example, in Figure 2B. In some embodiments, an increased angle between the first port 50 and the second port 52 may facilitate flushing of the first port 50 without flushing the second port 52. In some embodiments, a decreased angle between the first port 50 and the second port 52 may streamline fluid flow and instrument delivery into the catheter 40. In some

embodiments, streamlined fluid flow may be beneficial for infusion of highly viscous medications or medications that are time-dependent.

[0044] In some embodiments, an extension set may include one or more of the following: the first extension tube 42, the first connector 48, the second extension tube 54, and the second connector 60. In some embodiments, the second extension tube 54 may be shorter than the extension tube 16 of the prior art, which may result in less movement of the extension set and fewer problems in controlling the extension set. However, in some embodiments, the second connector 60 may be disposed about a same distance from the insertion site as the connector 17 of the prior art, which may decrease interference with the catheter 40 at the insertion site. In some embodiments, a length of the second extension tube 54 may be less than about 5.350 inches. In some embodiments, the length of the second extension tube 54 may be between about 4 and 7 inches. In some embodiments, the length of the second extension tube 54 may be less than about 6 inches or less than about 5.350 inches. The length of the second extension tube 54 may vary, according to some embodiments.

[0045] In some embodiments, the first connector 48 may include a Y-shape or a T-shape. In some embodiments, the first port 50 and the second port 52 may form arms of the Y-shape. In some embodiments, the first connector 48 may include a third port 64, which may form a trunk of the Y-shape.

[0046] In some embodiments, the first connector 48 may be selectively coupled to the first extension tube 42 and/or the second extension tube 54. In some embodiments, the first connector 48 may be permanently or non-removably coupled to the first extension tube 42 and/or the second extension tube 54. In some embodiments, the first port 50, the second port 52, and the third port 64 of the first connector 48 may include any suitable type of coupling mechanism.

[0047] In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may include a luer adapter, such as, for example, a slip or thread male or female luer adapter. In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may include a non-luer adapter. In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may include a blunt plastic cannula, such as, for example, the Baxter Interlink IV Access System. In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may include one or more barbs.

[0048] In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may be coupled to a needleless connector, such as, for example, the Becton Dickinson SMARTSITE™ needle-free valve, or another suitable needleless connector. In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may be closed by an end cap. In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may include a vent plug. In some embodiments, one or more of the first port 50, the second port 52, and the third port 64 may include one or more snap elements, examples of which are illustrated in Figure 7B.

[0049] In some embodiments, the distal end 58 of the second extension tube 54 may include a particular connector having a corresponding coupling mechanism to the first port 50. In some embodiments, the distal end 58 of the second extension tube 54 may be fixed inside the first connector 48. In some embodiments, the proximal end 44 of the first extension tube 42 may include a particular connector having a corresponding coupling mechanism to the third port 64 and/or the first port 50. In some embodiments, the proximal end 44 of the first extension tube 42 may be fixed inside the first connector 48, as illustrated, for example, in Figures 2A-2C.

[0050] In some embodiments, the catheter assembly 30 may not include the second extension tube 54 and/or the second connector 60. In some embodiments, the first connector 48 may only include the first port 50 and the third port 64, which may be disposed opposite the first port 50. In some embodiments, the first connector 48 may include more than three ports.

[0051] In some embodiments, the second connector 60 may be selectively coupled to the second extension tube 54. Alternatively, in some embodiments, the second connector 60 may be permanently or non-removably coupled to the second extension tube 54. In some embodiments, the second connector 60 may include multiple ports, which may each include any suitable type of coupling mechanism. For example, the second connector 60 may include a proximal port 68 and a distal port 70. In some embodiments, the second connector 60 may include a Y-shape or a T-shape.

[0052] In some embodiments, one or more of the multiple ports may include a luer adapter, such as, for example, a slip or thread male or female luer adapter. In some embodiments, one or more of the multiple ports may include a non-luer adapter. In some embodiments, one or more of the multiple ports may include a blunt plastic cannula, such as, for example, the Baxter Interlink IV Access System. In some embodiments, one or more of the multiple ports may include one or more barbs. In some embodiments, one or more of the multiple ports may be coupled to a needleless connector, such as, for example, the Becton Dickinson SMARTSITE™ needle-free valve, or another suitable needleless connector. In some embodiments, one or more of the one or more of the multiple ports may be closed by an end cap. In some embodiments, one or more of the multiple ports may include a vent plug. In some embodiments, one or more of the multiple ports may include one or more snap elements, examples of which are illustrated in Figure 7B. In some embodiments, the proximal end 56 of the second extension tube 54 may include a particular connector having a corresponding coupling mechanism to the distal port 70. In some embodiments,

the proximal end 56 of the second extension tube 54 may be fixed inside the second connector 60, as illustrated, for example, in Figures 2A-2C.

[0053] In some embodiments, the distal end 46 of the first extension tube 42 may be selectively coupled to the catheter adapter 32. Alternatively, in some embodiments, the distal end 46 of the first extension tube 42 may be permanently or non-removably coupled to the catheter adapter 32. In some embodiments, the distal end 46 of the first extension tube 42 may be fixed within the catheter adapter 32, as illustrated, for example, in Figures 2A-2C. In some embodiments, the side port 38 of the catheter adapter 32 may include a luer adapter, such as, for example, a slip or thread male or female luer adapter. In some embodiments, the side port 38 of the catheter adapter 32 may include a non-luer adapter. In some embodiments, the side port 38 of the catheter adapter 32 may include one or more snap elements, examples of which are illustrated in Figure 7B. In some embodiments, the distal end 46 of the first extension tube 42 may include a particular connector having a corresponding coupling mechanism to the side port 38.

[0054] In some embodiments, the first extension tube 42 may be coupled to the catheter adapter 32 and/or the first connector 48 prior to or after insertion of the catheter 40 into the vasculature of the patient and/or removal of an introducer needle from the catheter assembly 30. In some embodiments, the second extension tube 54 may be coupled to the first connector 48 prior to or after insertion of the catheter 40 into the vasculature of the patient and/or removal of an introducer needle from the catheter assembly 30.

[0055] Referring now to Figure 2C, in some embodiments, the third port 64 may extend proximally, and the first port 50 and the second port 52 may extend distally. In some embodiments, the first port 50 may direct the second extension tube 54 across the longitudinal axis 55 of the catheter adapter 32. In some embodiments, the second port 52 may be coupled to the proximal end

44 of the first extension tube 42. In some embodiments, the first connector 48 and/or the second connector 60 may be transparent, which may facilitate access, flow, flush, and manufacturing visibility.

[0056] Referring now to Figure 3A, an example connector 72 is illustrated. In some embodiments, the connector 72 may include or correspond to the first connector 48 and/or the second connector 60 discussed with respect to Figures 2A-2B. In some embodiments, a proximal end of the extension tube 74 may be fixed within a distal port 76 of the connector 72. In some embodiments, the proximal end of the extension tube 74 may include or correspond to the proximal end 44 of the first extension tube 42 and/or the proximal end 56 of the second extension tube 54. In some embodiments, the distal port 76 may include or correspond to the distal port 70 of the second connector 60 and/or the third port 64 of the first connector 48. In some embodiments, a proximal port 78 of the connector 72 may include or correspond to the proximal port 68 of the second connector 60 and/or the second port 52 of the first connector 48.

[0057] In some embodiments, the connector 72 may not include any catch points for fluid or the instrument 80 moving through the connector 72 in the distal direction. For example, the catch points 24, illustrated in Figure 1C, may be removed. In some embodiments, an entirety of a lumen 82 of the connector 72 tapers inwardly in the distal direction or expands to a larger diameter in the distal direction. In some embodiments, all portions of an inner surface of the connector 72 forming the lumen 82 that are perpendicular to a longitudinal axis of the connector 72 may be removed. In some embodiments, the connector 72 may or may not include a wedge to eliminate the catch points.

[0058] Referring now to Figure 3B, in some embodiments, the connector 72 may be shortened to facilitate rapid infusion of medications and instrument access. In some embodiments, a length

of the connector 72 may be between about 0.5 and 0.6 inches. In some embodiments, the length of the connector 72 may be about 0.57 inches.

[0059] Referring now to Figure 4A, in some embodiments, another connector 88 is illustrated, according to some embodiments. In some embodiments, the connector 88 may include or correspond to the first connector 48 and/or the second connector 60 discussed with respect to Figures 2A-2B. In some embodiments, the connector 88 may not include any catch points for fluid or the instrument 80 (illustrated, for example, in Figures 3A-3B) moving through the connector 88 in the distal direction to enter the catheter adapter 32. In some embodiments, catch points similar to the catch points 24, illustrated in Figure 1C, for example, may be removed from a fluid pathway between a proximal port and a distal port, or between the second port 52 and the third port 64 of Figures 2A-2B, for example. In some embodiments, the connector 88 may or may not include a wedge to eliminate the catch points.

[0060] Referring now to Figure 4B, a connector 90 may include or correspond to the first connector 48 and/or the second connector 60 discussed with respect to Figures 2A-2B. In some embodiments, the connector 90 may not include any catch points for fluid or the instrument 80 moving through the connector 90 in the distal direction to enter the catheter adapter 32. In some embodiments, catch points similar to the catch points 24, illustrated in Figure 1C, for example, may be removed from a fluid pathway between a proximal port and a distal port, or between the second port 52 and the third port 64 of Figures 2A-2B, for example. In some embodiments, the connector 90 may or may not include a wedge to eliminate the catch points.

[0061] Referring now to Figure 5, in some embodiments, a catheter assembly 92 may include two or more extension tubes 94 extending from the side port 38. In some embodiments, a single extension tube may bifurcate or split into the extension tubes 94. In some embodiments, the

bifurcation or splitting may occur within the side port 38 or outside of the side port 38. In some embodiments, the catheter assembly 92 may include or correspond to the prior art catheter assembly 10 discussed with respect to Figures 2A-2C. In further detail, in some embodiments, the catheter assembly 92 may include one or more features of the prior art catheter assembly 10 discussed with respect to Figures 2A-2C, such as, for example, the first connector 48 and/or the second connector 60. In some embodiments, one or more of the extension tubes 94 may include or correspond to the first extension tube 42 and/or the catheter assembly 92 may include multiple extension sets.

[0062] Referring now to Figure 6A-6B, in some embodiments, the catheter adapter 32 may include various configurations. In some embodiments, the catheter adapter 32 may include multiple side ports 38. As illustrated in Figure 6A, in some embodiments, a side port 38a may extend from a side of the catheter adapter 32 and/or another side port 38b may extend from a top of the catheter adapter 32. Additionally or alternatively, in some embodiments, another side port 38c may oppose the side port 38a. In some embodiments, the extension tubes 94 of Figure 5 may extend from any of the side ports 18 of Figures 6A-6B. In some embodiments, all or a portion of the extension set of Figures 2A-2C may extend from any of the side ports 38 of Figures 6A-6B. In some embodiments, the first extension tube 42 described with respect to Figures 2A-2C may extend from any of the side ports 18 of Figures 6A-6B.

[0063] Referring now to Figure 6C, in some embodiments, a distal end 96 of the catheter adapter 12 may include a needle port 98 and/or a distal port 100 from which an extension tube, such as, for example, the first extension tube 42 of Figures 2A-2C may extend. In some embodiments, the extension tubes 94 of Figure 5 may extend from the distal port 100. In some embodiments, the needle port 98 and the distal port 100 may be disposed vertically with respect to

each other, as illustrated, for example, in Figure 6C. In some embodiments, positioning of the distal port 100 towards a top of the catheter may facilitate entry of the instrument in to the catheter 40 and/or the vasculature of the patient at a downward angle. In some embodiments, the needle port 98 and the distal port 100 may be disposed horizontally with respect to each other.

[0064] Referring now to Figures 7A-7B, in some embodiments, one or more components of the catheter assembly 30 described with respect to Figures 2A-2C may be coupled together via a snap fit. For example, as illustrated in Figures 7A-7B, a proximal end of the first extension tube 42 may include a snap mechanism 102 having snap elements 104 configured to move past corresponding snap elements 106 of the first connector 48 and engage the first connector 48 and the first extension tube 42 together in a snap fit. In some embodiments, a blunt cannula 108 may penetrate a blood control valve 110 of the first connector 48. It is contemplated that the first connector may include the blunt cannula 108.

[0065] 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 peripheral intravenous catheter assembly, comprising:
 - a catheter adapter comprising a proximal end, a distal end, a lumen extending through the proximal end and the distal end, and a side port;
 - a first extension tube comprising a proximal end and a distal end, wherein the first extension tube extends from the side port;
 - a first connector coupled to the proximal end of the first extension tube, wherein the first connector comprises a first port and a second port;
 - a second extension tube comprising a proximal end and a distal end, wherein the distal end of the second extension tube is coupled to the first port, wherein the second extension tube is longer than the first extension tube; and
 - a second connector coupled to the proximal end of the second extension tube.
2. The peripheral intravenous catheter assembly of claim 1, wherein the first port directs the second extension tube distally.
3. The peripheral intravenous catheter assembly of claim 1, wherein the first port is disposed at an angle of less than 90° with respect to the second port.
4. The peripheral intravenous catheter assembly of claim 1, wherein the first port is disposed at an angle between 45° and 90° with respect to the second port.
5. The peripheral intravenous catheter assembly of claim 1, wherein the first port is perpendicular to the second port.
6. The peripheral intravenous catheter assembly of claim 1, wherein the second port is aligned with a longitudinal axis of the first connector.

7. The peripheral intravenous catheter assembly of claim 1, wherein the first connector comprises a Y-shape, wherein the first port and the second port form arms of the Y-shape, wherein the first connector comprises a third port forming a trunk of the Y-shape, wherein the third port extends proximally, wherein the first port and the second port extend distally.
8. The peripheral intravenous catheter assembly of claim 7, wherein the first port directs the second extension tube across a longitudinal axis of the catheter adapter.
9. The peripheral intravenous catheter assembly of claim 1, wherein the first connector does not include any catch points for fluid or a probe moving through the first connector in the distal direction.
10. The peripheral intravenous catheter assembly of claim 1, wherein the second connector does not include any catch points for fluid or a probe moving through the second connector in the distal direction.
11. The peripheral intravenous catheter assembly of claim 1, wherein a length of the first connector is about 0.57 inches.
12. The peripheral intravenous catheter assembly of claim 1, wherein the first connector is coupled to the proximal end of the first extension tube via a snap fit.
13. The peripheral intravenous catheter assembly of claim 1, wherein the proximal end of the first extension tube is fixed within the first connector.
14. The peripheral intravenous catheter assembly of claim 1, wherein further comprising a clamp disposed on the second extension tube.
15. The peripheral intravenous catheter assembly of claim 1, wherein the side port is a first side port, wherein the catheter adapter further comprises a second side port disposed on a top of the catheter adapter.

16. The peripheral intravenous catheter assembly of claim 1, wherein the side port is a first side port, wherein the catheter adapter further comprises a second side port opposing the first side port.
17. The peripheral intravenous catheter assembly of claim 1, further comprising:
 - a third extension tube comprising a proximal end and a distal end, wherein the third extension tube extends from second side port;
 - a third connector coupled to the proximal end of the third extension tube, wherein the third connector comprises a third port and a fourth port;
 - a fourth extension tube comprising a proximal end and a distal end, wherein the distal end of the fourth extension tube is coupled to the third port, wherein the fourth extension tube is longer than the third extension tube; and
 - a fourth connector coupled to the proximal end of the fourth extension tube.
18. The peripheral intravenous catheter assembly of claim 1, further comprising a third extension tube comprising a proximal end and a distal end, wherein the third extension tube extends from the distal end of the catheter adapter.
19. The peripheral intravenous catheter assembly of claim 18, wherein the distal end of the catheter adapter further comprises a needle port.
20. A peripheral intravenous catheter assembly, comprising:
 - a catheter adapter comprising a proximal end, a distal end, a lumen extending through the proximal end and the distal end, and a side port;
 - a first extension tube comprising a proximal end and a distal end, wherein the first extension tube extends from the side port;

a second extension tube comprising a proximal end and a distal end, wherein the second extension tube extends from the side port, wherein the second extension tube is longer than the first extension tube;

a first connector coupled to the proximal end of the first extension tube; and

a second connector coupled to the proximal end of the second extension tube.