

**RAPIDLY INSERTABLE CENTRAL CATHETERS INCLUDING CATHETER
ASSEMBLIES AND METHODS THEREOF**

PRIORITY

[0001] This application claims the benefit of priority to U.S. Patent Application No. 63/012,793, filed April 20, 2020, which is incorporated by reference in its entirety into this application.

BACKGROUND

[0002] A central venous catheter (“CVC”) is formed of a material having a relatively low durometer, which contributes to the CVC having a lack of column strength. Due to the lack of column strength, CVCs are commonly introduced into patients and advanced through their vasculatures by way of the Seldinger technique. The Seldinger technique utilizes a number of steps and medical devices (e.g., a needle, a scalpel, a guidewire, an introducer sheath, a dilator, a CVC, etc.). While the Seldinger technique is effective, the number of steps are time consuming, handling the number of medical devices is awkward, and both of the foregoing can lead to patient trauma. In addition, there is a relatively high potential for touch contamination due to the number of medical devices that need to be interchanged during the number of steps of the Seldinger technique. As such, there is a need to reduce the number of steps and medical devices involved in introducing a catheter such as a CVC into a patient and advancing the catheter through a vasculature thereof.

[0003] Disclosed herein are rapidly insertable central catheters (“RICCs”) and methods thereof that address the foregoing.

SUMMARY

[0004] Disclosed herein is a method for inserting a RICC into a blood-vessel lumen of a patient including, in some embodiments, a catheter assembly-obtaining step, a needle tract-establishing step, an introducer needle-removing step, an introducer catheter-advancing step, and a RICC-advancing step. The catheter assembly-obtaining step includes obtaining a catheter assembly including an introducer combination and the RICC. The introducer combination includes an introducer needle disposed in an introducer-catheter lumen of an introducer catheter. The RICC includes a catheter tube with an introducing lumen and a side opening through a side of the catheter tube that opens into the introducing lumen. The introducer

combination is disposed through the side opening, along a distal-end portion of the catheter tube within the introducing lumen, and through a distal end of the catheter tube. The needle tract-establishing step includes establishing a needle tract with a tip of the introducer needle. The needle tract extends from an area of skin to the blood-vessel lumen of the patient. The introducer needle-removing step includes removing the introducer needle from the introducer combination and leaving the introducer catheter in place. The introducer catheter-advancing step includes advancing the introducer catheter into the blood-vessel lumen. The RICC-advancing step includes advancing the RICC into the blood-vessel lumen over the introducer catheter until a distal end of the RICC is commensurate with a distal end of the introducer catheter, the RICC is pushed off the introducer catheter, or the distal end of the RICC is past the distal end of the introducer catheter but not pushed off the introducer catheter.

[0005] In some embodiments, the method further includes an introducer combination-disposing step of disposing the introducer combination in the side opening of the catheter tube.

[0006] In some embodiments, the method further includes an introducer combination-adjusting step and needle tip-ensuring step. The introducer combination-adjusting step includes adjusting the introducer combination such that at least about 1-7 cm of the introducer combination extends from the distal end of the RICC. The needle tip-ensuring step includes ensuring the tip of the introducer needle extends past the distal end of the introducer catheter before establishing the needle tract.

[0007] In some embodiments, the method further includes a blood-aspirating step of aspirating blood with a syringe fluidly connected to the introducer needle. The blood-aspirating step confirms the tip of the introducer needle is disposed in the blood-vessel lumen before removing the introducer needle from the introducer combination.

[0008] In some embodiments, introducer catheter-advancing step includes advancing the introducer catheter at least about 1-7 cm into the blood-vessel lumen. Advancing the introducer catheter at least about 1-7 cm into the blood-vessel lumen ensures the introducer catheter is sufficiently disposed in the blood-vessel lumen before the RICC-advancing step.

[0009] In some embodiments, the RICC is advanced into the blood-vessel lumen over the introducer catheter until the distal end of the RICC is commensurate with the distal end of the introducer catheter or the distal end of the RICC is past the distal end of the introducer catheter but not pushed off the introducer catheter in the RICC-advancing step.

[0010] In some embodiments, the method further includes an introducer catheter-removing step of removing the introducer catheter from the RICC through the side opening through the side of the catheter tube.

[0011] In some embodiments, advancing the RICC into the blood-vessel lumen over the introducer catheter until the RICC is pushed off the introducer catheter in the RICC-advancing step simultaneously removes the introducer catheter from the RICC through the side opening through the side of the catheter tube.

[0012] Also disclosed herein is a RICC including, in some embodiments, a catheter tube, a hub, and a number of extension legs extending from the hub. The catheter tube includes an introducing lumen of a number of catheter-tube lumens and a side opening through a side of the catheter tube. The introducing lumen extends from a proximal end of the catheter tube to a distal end of the catheter tube. The side opening opens into the introducing lumen in a distal-end portion of the catheter tube. The catheter tube is configured to accommodate an introducer needle, an introducer catheter, or a combination thereof through the side opening, along the distal-end portion of the catheter tube within the introducing lumen, and through the distal end of the catheter tube for introducing the RICC into a blood vessel of a patient. The hub is coupled to a proximal-end portion of the catheter tube. The hub includes a number of hub lumens equal in number to the number of catheter-tube lumens. The number of extension legs extending from the hub is equal in number to the number of catheter-tube lumens. Each extension leg of the number of extension legs includes an extension-leg lumen.

[0013] In some embodiments, the side opening is configured to seal when the introducer needle, the introducer catheter, or the combination thereof is removed from the RICC.

[0014] In some embodiments, the side opening is a puncture established by the introducer needle, the introducer catheter, or the combination thereof. The catheter tube around at least the puncture is formed of an elastomeric material configured to return to its default state when the introducer needle, the introducer catheter, or the combination thereof is removed from the puncture. The catheter tube around the puncture seals the puncture when returning to the default state.

[0015] In some embodiments, the catheter tube includes a flap over the side opening, extending into the side opening, or both configured to be held open by the introducer needle,

the introducer catheter, or the combination thereof. The flap is configured to return to its default state when the introducer needle, the introducer catheter, or the combination thereof is removed from the side opening. The flap seals the side opening when returning to the default state.

[0016] In some embodiments, the catheter tube includes an area of reinforcement about the side opening. The area of reinforcement is configured to maintain an integrity of the catheter tube about the side opening.

[0017] In some embodiments, the number of catheter-tube lumens, the number of hub lumens, and a number of extension-leg lumens is three. The RICC includes a set of three lumens including a distal lumen, a medial lumen, and a proximal lumen. The set of three lumens is formed of fluidly connected portions of the catheter-tube lumens, the hub lumens, and the extension-leg lumens.

[0018] In some embodiments, the distal lumen has a distal-lumen opening in a distal end of the RICC. The medial lumen has a medial-lumen opening in the side of the catheter tube distal of the side opening. The proximal lumen has a proximal-lumen opening in the side of the catheter tube distal of the side opening but proximal of the medial-lumen opening.

[0019] Also disclosed herein is a catheter assembly including, in some embodiments, an introducer catheter, an introducer needle, and a RICC. The introducer needle is disposed in an introducer-catheter lumen of the introducer catheter forming an introducer combination. The RICC includes a catheter tube including an introducing lumen of a number of catheter-tube lumens and a side opening through a side of the catheter tube. The introducing lumen extends from a proximal end of the catheter tube to a distal end of the catheter tube. The side opening opens into the introducing lumen in a distal-end portion of the catheter tube. The introducer combination is disposed through the side opening, along the distal-end portion of the catheter tube within the introducing lumen, and through the distal end of the catheter tube for introducing the RICC into a blood vessel of a patient.

[0020] In some embodiments, the catheter assembly further includes a syringe. The syringe includes a tip extending from a barrel of the syringe. The tip is configured as a Luer connector for connecting to a hub of the introducer needle, which hub is configured as a complementary Luer connector.

[0021] In some embodiments, the side opening is configured to seal when the introducer catheter is removed from the RICC.

[0022] In some embodiments, the side opening is a puncture established by the introducer needle. The catheter tube around at least the puncture is formed of an elastomeric material configured to return to its default state when the introducer catheter is removed from the puncture. The catheter tube around the puncture seals the puncture when returning to the default state.

[0023] In some embodiments, the catheter tube includes a flap over the side opening, extending into the side opening, or both configured to be held open by the introducer catheter. The flap is configured to return to its default state when the introducer catheter is removed from the side opening. The flap seals the side opening when returning to the default state.

[0024] In some embodiments, the catheter tube includes an area of reinforcement about the side opening. The area of reinforcement is configured to maintain an integrity of the catheter tube about the side opening.

[0025] In some embodiments, the RICC further includes a hub and a number of extension legs extending from the hub. The hub is coupled to a proximal-end portion of the catheter tube. The hub includes a number of hub lumens equal in number to the number of catheter-tube lumens. The number of extension legs extending from the hub is equal in number to the number of catheter-tube lumens. Each extension leg of the number of extension legs includes an extension-leg lumen.

[0026] In some embodiments, the number of catheter-tube lumens, the number of hub lumens, and a number of extension-leg lumens is three. The RICC includes a set of three lumens including a distal lumen, a medial lumen, and a proximal lumen. The set of three lumens is formed of fluidly connected portions of the catheter-tube lumens, the hub lumens, and the extension-leg lumens.

[0027] In some embodiments, the distal lumen has a distal-lumen opening in a distal end of the RICC. The medial lumen has a medial-lumen opening in the side of the catheter tube distal of the side opening. The proximal lumen has a proximal-lumen opening in the side of the catheter tube distal of the side opening but proximal of the medial-lumen opening.

[0028] These and other features of the concepts provided herein will become more apparent to those of skill in the art in view of the accompanying drawings and following description, which describe particular embodiments of such concepts in greater detail.

DRAWINGS

[0029] FIG. 1 illustrates a view of a catheter assembly including a RICC in accordance with some embodiments.

[0030] FIG. 2 illustrates a distal portion of a catheter tube of the RICC in accordance with some embodiments.

[0031] FIG. 3 illustrates a first transverse cross section of the catheter tube in accordance with some embodiments.

[0032] FIG. 4 illustrates a second or third transverse cross section of the catheter tube in accordance with some embodiments.

[0033] FIG. 5 illustrates a side opening in a side of the catheter tube in accordance with some embodiments.

DESCRIPTION

[0034] Before some particular embodiments are disclosed in greater detail, it should be understood that the particular embodiments disclosed herein do not limit the scope of the concepts provided herein. It should also be understood that a particular embodiment disclosed herein can have features that can be readily separated from the particular embodiment and optionally combined with or substituted for features of any of a number of other embodiments disclosed herein.

[0035] Regarding terms used herein, it should also be understood the terms are for the purpose of describing some particular embodiments, and the terms do not limit the scope of the concepts provided herein. Ordinal numbers (e.g., first, second, third, etc.) are generally used to distinguish or identify different features or steps in a group of features or steps, and do not supply a serial or numerical limitation. For example, “first,” “second,” and “third” features or steps need not necessarily appear in that order, and the particular embodiments including such features or steps need not necessarily be limited to the three features or steps. Labels such as “left,” “right,” “top,” “bottom,” “front,” “back,” and the like are used for convenience and are

not intended to imply, for example, any particular fixed location, orientation, or direction. Instead, such labels are used to reflect, for example, relative location, orientation, or directions. Singular forms of “a,” “an,” and “the” include plural references unless the context clearly dictates otherwise.

[0036] With respect to “proximal,” a “proximal portion” or a “proximal-end portion” of, for example, a catheter disclosed herein includes a portion of the catheter intended to be near a clinician when the catheter is used on a patient. Likewise, a “proximal length” of, for example, the catheter includes a length of the catheter intended to be near the clinician when the catheter is used on the patient. A “proximal end” of, for example, the catheter includes an end of the catheter intended to be near the clinician when the catheter is used on the patient. The proximal portion, the proximal-end portion, or the proximal length of the catheter can include the proximal end of the catheter; however, the proximal portion, the proximal-end portion, or the proximal length of the catheter need not include the proximal end of the catheter. That is, unless context suggests otherwise, the proximal portion, the proximal-end portion, or the proximal length of the catheter is not a terminal portion or terminal length of the catheter.

[0037] With respect to “distal,” a “distal portion” or a “distal-end portion” of, for example, a catheter disclosed herein includes a portion of the catheter intended to be near or in a patient when the catheter is used on the patient. Likewise, a “distal length” of, for example, the catheter includes a length of the catheter intended to be near or in the patient when the catheter is used on the patient. A “distal end” of, for example, the catheter includes an end of the catheter intended to be near or in the patient when the catheter is used on the patient. The distal portion, the distal-end portion, or the distal length of the catheter can include the distal end of the catheter; however, the distal portion, the distal-end portion, or the distal length of the catheter need not include the distal end of the catheter. That is, unless context suggests otherwise, the distal portion, the distal-end portion, or the distal length of the catheter is not a terminal portion or terminal length of the catheter.

[0038] With respect to “a number of” features or steps, the number of features or steps includes one or more features or steps. For example, a number of catheter-tube lumens of a catheter tube is intended to be one or more catheter-tube lumens of the catheter tube. Likewise, a number of extension legs of a catheter is intended to be one or more extension legs of the catheter.

[0039] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by those of ordinary skill in the art.

[0040] As set forth above, there is a need to reduce the number of steps and medical devices involved in introducing a catheter such as a CVC into a patient and advancing the catheter through a vasculature thereof. Disclosed herein are RICCs and methods thereof that address the foregoing.

Rapidly insertable central catheters

[0041] FIG. 1 illustrates a view of a catheter assembly 100 including a RICC 102 in accordance with some embodiments. FIG. 2 illustrates a distal portion of a catheter tube 104 of the RICC 102 in accordance with some embodiments. FIGS. 3 and 4 illustrate various transverse cross sections of the catheter tube 104 in accordance with some embodiments.

[0042] As shown the RICC 102 includes, in some embodiments, the catheter tube 104, a hub 106, and a number of extension legs 108 extending from the hub 106. The catheter tube 104, the hub 106, and the number of extension legs 108 are described in turn below.

[0043] The catheter tube 104 includes an introducing lumen 110 of a number of catheter-tube lumens. The introducing lumen 110 extends from a proximal end of the catheter tube 104 to a distal end of the catheter tube 104, which distal end of the catheter tube 104 corresponds with a distal end of a tip 112 of the RICC 102 in some embodiments. That is, in some embodiments, the tip 112 of the RICC 102 is formed of a distal-end portion of the catheter tube 104. In other embodiments, however, the tip 112 is formed separately and coupled to the distal end of the catheter tube 104. In such embodiments, the introducing lumen 110 further extends from the distal end of the catheter tube 104 to the distal end of the tip 112. Regardless, the catheter tube 104 is configured to accommodate an introducer needle, an introducer catheter, or an introducer combination thereof (i.e., the introducer catheter over the introducer needle) along the distal-end portion of the catheter tube 104 within the introducing lumen 110 and through the distal end of the catheter tube 104 or the tip 112 for introducing the RICC 102 into a blood vessel of a patient. The distal end of the catheter tube 104 or the tip 112 is configured to have an engineering fit such as a clearance fit (e.g., a free running, easy running, close running, sliding, or location clearance fit) or transition fit (e.g., a tight, similar, or fixed transition fit) with the introducer needle, the introducer catheter, or the introducer combination thereof in accordance with the International Organization for Standardization's ("ISO's")

geometrical product specification for tolerances, specifically ISO 286. Such an engineering fit facilitates a smooth transition from the distal end of the catheter tube 104 or the tip 112 to the introducer needle, the introducer catheter, or the introducer combination thereof leaving little space for skin or other tissue to get caught between the distal end of the catheter tube 104 or the tip 112 and the introducer needle, the introducer catheter, or the introducer combination.

[0044] The catheter tube 104 can include a side opening 114 through a side of the catheter tube 104. When present, the side opening 114 is about 1-4 cm from the distal end of the catheter tube 104 or the tip 112 and opens into the introducing lumen 110 in the distal-end portion of the catheter tube 104. The catheter tube 104 is further configured to accommodate the introducer needle, the introducer catheter, or the introducer combination through the side opening 114, as well as along the distal-end portion of the catheter tube 104 within the introducing lumen 110, and through the distal end of the catheter tube 104 or the tip 112 for introducing the RICC 102 into the blood vessel of the patient.

[0045] FIG. 5 illustrates the side opening 114 in the side of the catheter tube 104 in accordance with some embodiments.

[0046] As shown, the side opening 114 can be a self-sealing side opening configured to seal when the introducer needle, the introducer catheter, or the introducer combination is removed from the RICC 102.

[0047] In an example, the catheter tube 104 can include a flap 116 (e.g., a small piece of elastomeric material adhered to the catheter tube 104) over the side opening 114, extending into the side opening 114, or both. The flap 116 is configured to be held open by the introducer needle, the introducer catheter, or the introducer combination. The flap 116 is configured to return to its default state when the introducer needle, the introducer catheter, or the introducer combination is removed from the side opening 114. The flap 116 seals the side opening 114 when returning to the default state.

[0048] In another example, the catheter tube 104 can include a puncture established by the introducer needle, the introducer catheter, or the combination thereof as the side opening 114. The catheter tube 104 around at least the side opening 114 (e.g., the puncture) is formed of an elastomeric material configured to return to its default state when the introducer needle, the introducer catheter, or the combination thereof is removed from the side opening 114. The catheter tube 104 around the side opening 114 (e.g., the puncture) seals the side opening 114

when returning to the default state. Alternatively or additionally, the catheter tube 104 can include the area or reinforcement 118 set forth below, which serves the same function as the catheter tube 104 around the side opening 114 (e.g., the puncture) being formed of an elastomeric material.

[0049] Notwithstanding the foregoing self-sealing embodiments of the side opening 114, the side opening 114 can be configured to remain open at all times, even when the introducer needle, the introducer catheter, or the introducer combination is removed from the side opening 114.

[0050] When the side opening 114 is not present, the medial-lumen opening 120 or the proximal-lumen opening 122 set forth below can be used for the introducer needle, the introducer catheter, or the introducer combination. Like that set forth above for the puncture established by the introducer needle, the introducer catheter, or the introducer combination as the side opening 114, the catheter tube 104 can include a puncture established by the introducer needle, the introducer catheter, or the introducer combination through a septum separating the distal lumen from the medial lumen or the proximal lumen via the medial-lumen opening 120 or the proximal-lumen opening 122. Again, the catheter tube 104 can be formed of an elastomeric material configured to return to its default state and seal when the introducer needle, the introducer catheter, or the combination thereof is removed from the puncture via the medial-lumen opening 120 or the proximal-lumen opening 122.

[0051] The catheter tube 104 can include an area of reinforcement 118 about the side opening 114. For example, the area of reinforcement 118 can be a segment of the catheter tube 104 that is slightly thicker, a segment of the catheter tube 104 of a different polymeric material such as a more durable or more elastomeric material, a band over the catheter tube 104 of a more durable or more elastomeric material, or the like. The area of reinforcement 118 is configured to maintain structural integrity of the catheter tube 104 about the side opening 114 such as when the introducer needle, the introducer catheter, or the combination thereof is disposed in the side opening 114 and the catheter assembly is being manipulated.

[0052] The hub 106 is coupled to a proximal-end portion of the catheter tube 104.

[0053] The hub 106 includes a suture wing with through holes for suturing the hub 106 to the patient.

[0054] The hub 106 includes a number of hub lumens equal in number to the number of catheter-tube lumens. Each hub lumen of the number of hub lumens is fluidly connected a catheter tube lumen of the number of catheter tube lumens.

[0055] The number of extension legs 108 extend from the hub 106. The number of extension legs 108 are equal in number to the number of hub lumens, which, in turn, are equal in number to the number of catheter-tube lumens. Each extension leg of the number of extension legs 108 includes an extension-leg lumen fluidly connected to a hub lumen of the number of hub lumens.

[0056] While the RICC 102 can include any number of lumens, the RICC 102 of FIGS. 1-4 is triluminal with three catheter-tube lumens, three hub lumens, and three extension-leg lumens. Indeed, the RICC 102 includes a set of three lumens including a distal lumen, a medial lumen, and a proximal lumen formed of fluidly connected portions of the three catheter-tube lumens, the three hub lumens, and the three extension-leg lumens. As shown, the distal lumen has a distal-lumen opening in a distal end of the RICC 102. The medial lumen has a medial-lumen opening 120 in the side of the catheter tube 104 proximal of the distal-lumen opening but distal of the side opening 114 when present. The proximal lumen has a proximal-lumen opening 122 in the side of the catheter tube 104 proximal of the medial-lumen opening 120 but distal of the side opening 114 when present. However, the RICC 102 is not limited to the foregoing arrangement of openings. Indeed, while the distal-lumen opening, the medial-lumen opening 120, and the proximal-lumen opening 122 are generally arranged as set forth, the side opening 114, when present, can be distal of the medial-lumen opening 120, between the medial-lumen opening 120 and the proximal-lumen opening 122, or proximal of the proximal-lumen opening 122 as shown.

Catheter assemblies

[0057] FIG. 1 illustrates a view of the catheter assembly 100 including the RICC 102 in accordance with some embodiments.

[0058] As shown the catheter assembly 100 includes, in some embodiments, the RICC 102 and the introducer combination of an introducer needle 124 disposed in an introducer catheter 126, which introducer combination, in turn, is disposed in the side opening 114 of the catheter tube 104 of the RICC 102.

[0059] The catheter assembly 100 can further include a syringe 128. The syringe 128 includes a tip extending from a barrel of the syringe 128. The tip is configured as a Luer connector for connecting to a hub of the introducer needle 124, which hub is configured as a complementary Luer connector to that of the syringe 128.

[0060] The catheter assembly 100 can be packaged with the introducer combination disposed in the side opening 114 of the catheter tube 104 of the RICC 102 for immediate use once removed from a package containing the catheter assembly 100. Alternatively, the catheter assembly 100 can be packaged with the introducer combination separated from the RICC 102. Regardless, instructions for use can be included in the package for using the catheter assembly 100 including assembling the catheter assembly 100 (e.g., disposing the introducer combination in the catheter tube 104 of the RICC 102) if needed.

Methods

[0061] A method of the catheter assembly 100 or the RICC 102 thereof includes a method for inserting the RICC 102 into a blood-vessel lumen of a patient. Such a method includes, in some embodiments, a catheter assembly-obtaining step, a needle tract-establishing step, an introducer needle-removing step, an introducer catheter-advancing step, and a RICC-advancing step.

[0062] The catheter assembly-obtaining step includes obtaining the catheter assembly 100 including the RICC 102 and the introducer combination such as in or from a package thereof. As set forth above, the RICC 102 can include the catheter tube 104 with the side opening 114 through the side of the catheter tube 104 that opens into the introducing lumen 110. The introducer combination includes the introducer needle 124 disposed in the introducer-catheter lumen of the introducer catheter 126. The introducer combination can be disposed through the side opening 114 of the RICC 102, along the distal-end portion of the catheter tube 104 within the introducing lumen 110, and through the distal end of the catheter tube 104 or the tip 112.

[0063] If the catheter assembly 100 is not already assembled, the method can further include an introducer combination-disposing step of disposing the introducer combination in the side opening 114 of the catheter tube 104. Disposing the introducer combination in the side opening 114 of the catheter tube 104 can include establishing the side opening 114 of the catheter tube 104 with a tip of the introducer needle 124.

[0064] Whether the catheter assembly 100 is already assembled or not, the method can further include an introducer combination-adjusting step and a needle tip-ensuring step. The introducer combination-adjusting step includes adjusting the introducer combination such that at least about 1-7 cm of the introducer combination extends from the distal end of the RICC 102. (*See*, for example, FIG. 1.) The needle tip-ensuring step includes ensuring the tip of the introducer needle 124 extends past the distal end of the introducer catheter 126 before the needle tract-establishing step.

[0065] The needle tract-establishing step includes establishing a needle tract with the tip of the introducer needle 124 while the introducer combination is disposed in the RICC 102. Once established, the needle tract should extend from an area of skin to the blood-vessel lumen of the patient.

[0066] The method can further include a blood-aspirating step of aspirating blood with the syringe 128 fluidly connected to the introducer needle 124. The blood-aspirating step confirms the tip of the introducer needle 124 is disposed in the blood-vessel lumen before removing the introducer needle 124 from both the patient and the introducer combination.

[0067] Following the blood-aspirating step but before removing the introducer needle 124 from both the patient and the introducer combination, the method can further include a syringe-disconnecting step of disconnecting the syringe 128 from the hub of the introducer needle 124. Once the syringe 128 is disconnected from the hub of the introducer needle 124, an access guidewire can be advanced into the blood-vessel lumen through a needle lumen of the introducer needle 124 in an access-guidewire advancing step.

[0068] The introducer catheter-advancing step includes advancing the introducer catheter 126 into the blood-vessel lumen such as over the introducer needle 124, the access guidewire extending into the blood-vessel lumen from the needle lumen of the introducer needle 124, or a combination thereof. For example, the introducer catheter-advancing step includes advancing the introducer catheter 126 at least about 1-7 cm into the blood-vessel lumen. Advancing the introducer catheter at least about 1-7 cm into the blood-vessel lumen ensures the introducer catheter 126 is sufficiently disposed in the blood-vessel lumen before the RICC 102-advancing step.

[0069] The introducer needle-removing step includes removing the introducer needle 124 from both the patient and the introducer combination while leaving the introducer catheter

126 in place in both the patient and the RICC 102. If the access guidewire is advanced into the blood-vessel lumen in the access-guidewire advancing step, the introducer needle-removing step can include removing the access-guidewire as well.

[0070] The RICC-advancing step includes advancing the RICC 102 into the blood-vessel lumen over the introducer catheter 126 until the distal end of the RICC 102 is commensurate with a distal end of the introducer catheter 126, the RICC 102 is pushed off the introducer catheter 126, or the distal end of the RICC 102 is past the distal end of the introducer catheter 126 but not pushed off the introducer catheter 126.

[0071] With respect to advancing the RICC 102 into the blood-vessel lumen over the introducer catheter 126 until the distal end of the RICC 102 is commensurate with a distal end of the introducer catheter 126, the method can further subsequently include a first introducer catheter-removing step of removing the introducer catheter 126 from the RICC 102 through the side opening 114 through the side of the catheter tube 104. Once the introducer catheter 126 is removed from the RICC 102 through the side opening 114 of the catheter tube 104, the introducer catheter 126 can be completely removed from the blood-vessel lumen in a second introducer catheter-removing step of removing the introducer catheter 126 from the patient.

[0072] With respect to advancing the RICC 102 into the blood-vessel lumen over the introducer catheter 126 until the distal end of the RICC 102 is past the distal end of the introducer catheter 126 but not pushed off the introducer catheter in the RICC-advancing step, the method can also subsequently include the first introducer catheter-removing step of removing the introducer catheter 126 from the RICC 102 through the side opening 114 through the side of the catheter tube 104. Again, once the introducer catheter 126 is removed from the RICC 102 through the side opening 114 of the catheter tube 104, the introducer catheter 126 can be completely removed from the blood-vessel lumen in the second introducer catheter-removing step of removing the introducer catheter 126 from the patient.

[0073] However, with respect to advancing the RICC 102 into the blood-vessel lumen over the introducer catheter 126 until the RICC 102 is pushed off the introducer catheter 126, the first introducer catheter-removing step is not needed. Indeed, advancing the RICC 102 into the blood-vessel lumen over the introducer catheter until the RICC 102 is pushed off the introducer catheter simultaneously removes the introducer catheter 126 from the RICC 102 through the side opening 114 through the side of the catheter tube 104. Again, once the

introducer catheter 126 is removed from the RICC 102 through the side opening 114 of the catheter tube 104, the introducer catheter 126 can be completely removed from the blood-vessel lumen in the second introducer catheter-removing step of removing the introducer catheter 126 from the patient.

[0074] The method can further include a maneuver guidewire-advancing step of advancing a maneuver guidewire into the blood-vessel lumen by way of, for example, the distal-lumen opening in the distal end of the RICC 102. The maneuver guidewire can be used to further advance the RICC 102 into the blood-vessel such as to the lower $\frac{1}{3}$ of the superior vena cava (“SVC”) of the heart before the maneuver guidewire is removed. As set forth above, the introducing lumen 110 from the distal-end portion of the catheter tube 104 through the distal end of the catheter tube 104 or the tip 112 is configured to accommodate the introducer needle, the introducer catheter, or the introducer combination. When that portion of the introducing lumen 110 includes the introducer needle, the introducer catheter, or the introducer combination, the introducer needle, the introducer catheter, or the introducer combination must be removed before the maneuver guidewire-advancing step to ensure the introducing lumen 110 is free of the introducer needle, the introducer catheter, or the introducer combination.

[0075] While some particular embodiments have been disclosed herein, and while the particular embodiments have been disclosed in some detail, it is not the intention for the particular embodiments to limit the scope of the concepts provided herein. Additional adaptations and/or modifications can appear to those of ordinary skill in the art, and, in broader aspects, these adaptations and/or modifications are encompassed as well. Accordingly, departures may be made from the particular embodiments disclosed herein without departing from the scope of the concepts provided herein.