

OPTIMIZED STRUCTURAL SUPPORT IN CATHETER INSERTION SYSTEMS

PRIORITY

[0001] This application claims the benefit of priority to U.S. Provisional Application No. 63/128,694, filed December 21, 2020, which is incorporated by reference in its entirety into this application.

SUMMARY

[0002] Briefly summarized, embodiments disclosed herein are directed to optimized structural support devices for catheter insertion systems, and associated methods thereof. Conventional methods of placing elongate catheters, such as such as central venous catheters (CVC), rapid insertion central catheters (RICC), or the like, require repeated insertion and removal of multiple devices from the insertion site, and direct handling of the placement tools, catheters, devices etc. that enter the patient. Direct handling of these devices during insertion is often required to prevent buckling or kinking when an axial force is applied.

[0003] Advanced catheter insertion systems have been developed that include housings, needles, guidewires, dilators, and/or blood flash indicators configured to access the vasculature, confirm correct vascular access, dilate the insertion site and place the catheter. Advantageously, such advanced catheter insertion systems can contain the aforementioned structures within an enclosed environment to enable a “touch-free” placement of the catheter and mitigate the introduction of pathogens. Nonetheless, these insertion systems can still leave a portion of the catheter unsupported during placement, exposing the catheter to buckling or kinking when urged axially into the insertion site.

[0004] Further, when accessing the vasculature to place the catheter, a longer needle length is desirable to accommodate a broader patient base. The longer needle length can access deeper veins or penetrate deeper surface tissues. However, longer needles provide longer bending arms, i.e. a length of unsupported needle. A shorter needle bending arm, i.e. a shorter unsupported needle length, is preferable since this provides less flexion, increased accuracy, and increased tactile feedback to the clinician when accessing the vasculature. Since these advanced catheter insertion systems are provided with a needle “pre-loaded,” needle exchange is not feasible and either an entirely different system must be provided to suit different patients,

e.g. pediatric or adult, or a clinician must support the needle by manipulating needle itself as it enters the body, risking infection. Embodiments disclosed herein are directed to catheter placement systems with increased structural support devices to resolve the aforementioned problems.

[0005] Disclosed herein is a catheter placement system including, a needle supported by a needle hub, a catheter defining a catheter lumen, the needle extending through a portion of the catheter lumen, and a housing including, a body, a catheter advancement assembly releasably engaged with a hub of the catheter, the catheter advancement assembly slidably engaged with the body between a proximal position, a medial position, and a distal position, and a distal support slidably engaged with the body between a retracted position and an extended position, the distal support including a nose portion defining a channel to receive a portion of the catheter therethrough.

[0006] In some embodiments, the distal support is configured to transition the catheter assembly from the proximal position to the medial position as the distal support is transitioned from the retracted position to the extended position. In some embodiments, the catheter advancement assembly is configured to transition the distal support from the retracted position to the extended position as the catheter advancement assembly is transitioned from the medial position to the distal position. In some embodiments, the catheter advancement assembly includes an abutment and the body includes a cam surface, the abutment configured to engage the cam surface to urge a first portion of the body laterally apart from a second portion of the body, as the catheter advancement assembly is transitioned from the medial position to the distal position.

[0007] In some embodiments, the nose portion includes a door hingedly engaged therewith, and rotatable to an open position to allow egress of the portion of the catheter from the channel. The distal support is configured to extend distally from the housing to maintain the nose portion within a predetermined distance from a tip of the needle. The predetermined distance is a needle bending arm length of 7 cm or less. In some embodiments, the catheter placement system further includes a blood flash indicator configured to receive a blood flow from the needle lumen. In some embodiments, the catheter is a CVC catheter or a RICC catheter.

[0008] Also disclosed is a method of placing a catheter within a vasculature of a patient including, accessing the vasculature with a needle, the needle extending from a housing and including a portion of the catheter disposed annularly thereon, sliding a catheter advancement assembly from a proximal position to a medial position to advance a portion of the catheter into the vasculature, actuating a distal support from a retracted position to an extended position, advancing the catheter advancement assembly from the medial position to a distal position, separating a first portion of the housing laterally apart from a second portion of the housing, and disengaging the housing transversely upward from the catheter.

[0009] In some embodiments, the catheter advancement assembly includes an abutment configured to engage a cam surface of the housing body to separate the first portion of the housing laterally apart from the second portion of the housing, as the catheter advancement assembly transitions from the medial position to the distal position. In some embodiments, the distal support includes a nose portion defining a channel and is slidably engaged with the catheter, the nose portion providing rigid columnar support to a portion of the catheter as the catheter advancement assembly transitions from the medial position to the distal position. In some embodiments, the nose portion includes a door hingedly coupled thereto and configured to transition from a closed position to an open position to allow egress of the catheter from the channel along an axis perpendicular to a longitudinal axis.

[0010] In some embodiments, the method further includes withdrawing a needle proximally, prior to advancing the catheter advancement assembly from the proximal position. In some embodiments, the catheter advancement assembly releasably engages a portion of the catheter in an interference fit, press-fit, or snap-fit engagement. In some embodiments, the method further includes extending the distal support distally from the housing to maintain the nose portion within a predetermined distance from a tip of the needle. In some embodiments, the predetermined distance is a needle bending arm length of 7 cm or less. In some embodiments, the method further includes sliding a blood flash indicator along a longitudinal axis to create a vacuum and draw a blood flow through a lumen of the needle. In some embodiments, the catheter is a CVC catheter or a RICC catheter.

DRAWINGS

[0011] A more particular description of the present disclosure will be rendered by reference to specific embodiments thereof that are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are

therefore not to be considered limiting of its scope. Example embodiments of the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0012] FIG. 1A shows a perspective view of an exemplary catheter insertion system, in accordance with embodiments disclosed herein.

[0013] FIG. 1B shows a side view of an exemplary catheter insertion system, in accordance with embodiments disclosed herein.

[0014] FIG. 1C shows a plan view of an exemplary catheter insertion system, in accordance with embodiments disclosed herein.

[0015] FIG. 2A shows an exploded view of an exemplary catheter insertion system, in accordance with embodiments disclosed herein.

[0016] FIG. 2B shows an exploded view of a housing of an exemplary catheter insertion system, in accordance with embodiments disclosed herein.

[0017] FIGS. 3A-3J show an exemplary method of use for a catheter insertion system, in accordance with embodiments disclosed herein.

DESCRIPTION

[0018] 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.

[0019] 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.

[0020] In the following description, the terms “or” and “and/or” as used herein are to be interpreted as inclusive or meaning any one or any combination. As an example, “A, B or C” or “A, B and/or C” mean “any of the following, A, B, C, A and B, A and C, B and C, A, B and C.” An exception to this definition will occur only when a combination of elements, components, functions, steps or acts are in some way inherently mutually exclusive.

[0021] 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.

[0022] 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.

[0023] To assist in the description of embodiments described herein, as shown in FIG. 1A, a longitudinal axis extends substantially parallel to an axial length of the catheter. A lateral axis extends normal to the longitudinal axis, and a transverse axis extends normal to both the longitudinal and lateral axes. A horizontal plane can be defined by the longitudinal and lateral axes, a vertical plane can extend perpendicular to the horizontal plane. 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.

[0024] FIGS. 1A-2A show an exemplary catheter insertion system (“system”) 100, generally including a needle 110, a catheter 120, a housing 130, and a blood flash indicator 150. Optionally, the insertion system 100 can further include one or more guidewires (not shown). The needle 110 can define a needle lumen 114 and is supported by a needle hub 112 disposed at a proximal end thereof. The needle 110 can be configured to extend through at least a portion of a lumen of the catheter 120. A distal tip 116 of the needle 110 can extend distally of the distal tip of the catheter 120 and can define a sharpened tip configured for skin puncture and vascular access.

[0025] The catheter 120 can be a central venous catheter (CVC), a rapid insertion central catheter (RICC), or similar elongate catheter configured to provide access to a vasculature of a patient. As shown in FIG. 2A, the catheter 120 can be a RICC catheter 120 including an access section 162 defining a first diameter, a dilation section 164, and a catheter body section 166 defining a second diameter, larger than the first diameter.

[0026] The access section 162 can define a single lumen and can be formed of a harder durometer material relative to the catheter body section 166. The catheter body section 166 can define one or more lumen and can be formed of a softer, more compliant material relative to the access section 162. The dilation section 164 can be formed of either the same material as the access section 162, or of a third material. The third material can be of a harder durometer relative to the material of the catheter body section 166. The dilation section 164 can provide a tapered transition between the first diameter of the access section 162 and the second diameter of the catheter body section 166. The access section 162 and the dilation section 164 can provide relatively more rigid mechanical properties and can be relatively more resistant to kinking or collapsing when an axial force is applied thereto, relative to the catheter body section 166. The catheter body section 166 can be relatively more compliant to facilitate negotiating tortuous vascular pathways. In an embodiment, the catheter 120 can further include a hub 168,

a bifurcation 170, and/or one or more extension 172 legs each communicating with a lumen of the catheter 120. In an embodiment, the needle 110 can extend through an extension leg 172, through a lumen of the catheter body section 166 and through a lumen of the access section 162 to extend distally of a distal tip of the catheter 120.

[0027] The catheter insertion system 100 can further include a housing 130 configured to support the needle 110 and the catheter 120, as described in more detail herein. The catheter insertion system 100 can further include a blood flash indicator 150 in fluid communication with the needle lumen 114. The blood flash indicator 150 can include a container configured to receive a blood flow therein. The container can be formed of a transparent material to allow a user to observe a color and pulsatile flow disposed therein. In an embodiment, the blood flash indicator can include a vacutainer configured to maintain a vacuum therein to facilitate drawing a blood flow proximally through the needle lumen 114 and into the vacutainer.

[0028] In an embodiment, the blood flash indicator 150 can include a syringe barrel 154 and a plunger 156, slidably engaged therewith and configured to create a vacuum to draw a blood flow proximally through the needle lumen 114 and into the syringe barrel 154. In an embodiment, the plunger 156 can be fixedly engaged with the housing 130 to prevent any longitudinal movement relative thereto. The plunger 156 can be engaged with the housing 130 with an interference fit, snap-fit, press-fit engagement, adhesive, weld, bonding, or the like. The syringe barrel 154 can be supported by a barrel cradle 158. The barrel 154 and barrel cradle 158 assembly can be slidable relative to the plunger 156 and housing 130 assembly, and configured such that sliding the barrel 154 and cradle 158 assembly proximally can create a vacuum within the barrel 154. In an embodiment, the barrel cradle 158 can be formed of a transparent material.

[0029] In an embodiment, the blood flash indicator 150 can be fluidly coupled with the needle lumen 114 by way of a flexible tube 152, or the like. Advantageously, the flexible tube 152 can allow the syringe barrel to slide proximally relative to the needle interface 140. Advantageously, by reversing the operation of the syringe blood flash indicator 150, the syringe barrel 154 can be slid proximally to create the vacuum and reduce a length of the fluid path between the blood flash indicator 150 and the needle tip 116. Further, the action of the syringe barrel 154 and plunger 156 still allows a clinician to leverage the tactile and visual feedback offered via syringe-based blood flashback systems. Advantageously, moving the syringe barrel 154 proximally moves the barrel 154 away from the distal end of the insertion device 100

providing a clearer line of sight at the insertion site and allows for operations to occur, for example the manipulation of guidewire advancement assemblies, catheter advancement assemblies, hinging housing portions, or the like.

[0030] In use, a clinician can access a vasculature by inserting a needle tip 116 and a distal portion of the access section 162 into the vasculature. A blood flow can flow proximally through the needle lumen 114 to a blood flash indicator 150. A color and pulsatile flow can be observed to confirm correct vascular access. In case of incorrect vascular access, the access section 162 can be withdrawn and the insertion site closed by applying pressure, due to the relatively small diameter of the access section 162. Where correct vascular access is confirmed, the catheter 120 can be advanced, optionally over a guidewire, until a dilation section 164 enters the insertion site and dilates the insertion site to the second diameter of the catheter body section 166. The catheter body section 166 can then be advanced until a distal portion of the catheter is at a target location within the vasculature. Further details of RICC catheters and associated insertion systems and methods can be found in U.S. Patent No. 10,376,675; U.S. Patent Publications U.S. 2019/0255294, U.S. 2021/0069471, U.S. 2021/0085927, U.S. 2021/0113809, U.S. 2021/0113810, U.S. 2021/0121661, U.S. 2021/0121667, U.S. 2021/0228843, U.S. 2021/0322729, U.S. 2021/0330941, U.S. 2021/0330942, and U.S. 2021/0361915, each of which are incorporated by reference in its entirety into this application.

[0031] FIG. 2B shows further details of the housing 130 generally including a body 132, a distal support 134, a catheter advancement assembly 136 and a blood flash indicator 150. The housing 130 can include a body 132 including a needle interface 140 disposed at a proximal end and configured to provide fluid communication between the needle lumen 114 and the blood flash indicator 150 by way of an aperture 118 disposed in a wall of the needle 110. A distal support 134 can be slidably engaged with the body 132 along a longitudinal axis between a retracted position (FIG. 3D) and an extended position (FIG. 3E). The distal support 134 can include a handle 178 configured to allow a user to grasp the distal support 134 and transition the distal support 134 between the retracted position and the extended position.

[0032] The distal support 134 can further include a nose portion 180 disposed at a distal end and defining a channel 182 extending along the longitudinal axis and configured to receive a portion of the catheter 120 therethrough. The catheter 120 can be slidably engaged with the channel 182. As such, the distal support 134 can engage the catheter 120 and provide a rigid, columnar support to the catheter 120 to prevent buckling or kinking of the catheter 120 when

a longitudinal axial force is applied. Further, as described in more detail herein, the distal support 134 can extend distally to support a portion of the catheter 120 that has been advanced from the housing 130. This can provide columnar support to the catheter 120 while preventing a user from having to touch portions of the catheter 120 that are intended to enter the body of the patient.

[0033] In like manner, the distal support 134 can also provide rigid support to a portion of the needle 110. As described herein, while a longer needle can be advantageous to accommodate a broader patient base, access deeper veins, or penetrate deeper surface tissues, a shorter bending arm (x) (FIG. 1A) is preferred to provide improved accuracy, and improved tactile feedback. Typically a bending arm (x) length of 7 cm or less is preferred however, greater or lesser lengths are also contemplated depending on the material or structure of the needle 110. As such, where a needle tip 116 is extended from the housing 130 beyond the predetermined bending arm length (x), a user can extend the distal support 134 to provide a ridged support to the needle 110 within the predetermined bending arm length (x) from the needle tip 116.

[0034] In an embodiment, the nose portion 180 can include one or more doors 138 hingedly coupled with the distal support 134. In an embodiment, as shown in FIG. 3I, the door(s) 138 can rotate through an arc extending through a vertical plane, perpendicular to the longitudinal axis between a closed position and an open position. In an embodiment, as shown in FIG. 3H, the door(s) 138 can rotate laterally through an arc extending through a horizontal plane, between a closed position and an open position. In the closed position, the door 138 can prevent egress of the portion of catheter 120 from the channel 182. In the opening position, the door 138 can allow ingress or egress of the portion of catheter 120 to/from the channel 182.

[0035] In an embodiment, the catheter advancement assembly 136 can be slidably engaged with the body 132 along the longitudinal axis between a proximal position (FIG. 3C), a medial position (FIG. 3D), and a distal position (FIG. 3E). The catheter advancement assembly 136 can releasably engage a portion of the catheter 120. For example, the catheter advancement assembly 136 can releasably retain the catheter hub 168 in an interference fit, press-fit, or snap-fit engagement. However it will be appreciated that other mechanisms to releasably engage the catheter 120 are also contemplated. Further, it will be appreciated that the catheter advancement assembly 136 can engage other portions of the catheter 120, for example, the catheter body section 166, the bifurcation 170, combinations thereof, or the like.

Sliding the catheter advancement assembly 136 between the proximal position, medial position, and distal position can advance the catheter 120 along a longitudinal axis.

[0036] FIGS. 3A-3J show an exemplary method of use for the catheter insertion system 100. As shown in FIG. 3A, a user can grasp the housing 130 and advance a needle tip 116 through a skin surface 80 of the patient to create an insertion site 90 and access a vasculature of the patient therebelow. As described herein, the needle tip 116 can extend from the housing 130 by a predetermined distance (x). The predetermined distance (x), i.e., needle bending arm, will be within a tolerance to provide support to the needle 110, but to prevent bending or breaking of the needle 110 when a force is applied. In an embodiment, the predetermined distance (x) is equal to or less than 7cm, however, greater or lesser values are also contemplated. As will be appreciated, the predetermined distance (x) can vary depending on the structure and material of the needle 110.

[0037] As shown in FIG. 3B, a user can actuate a barrel cradle 158 to slide the syringe barrel 154 in a proximal direction relative to the housing body 132. The plunger 156, being coupled to the housing body 132, remains stationary relative to the housing 130, as the barrel 154 slides proximally, creating a vacuum within the syringe barrel 154. The vacuum draws a blood flow proximally through the needle lumen 114, through the needle aperture 118, through the needle interface 140, through the flexible tube 152 and into the syringe barrel 154. As noted herein, the syringe barrel 154 and optionally the barrel cradle 158 can be formed of a transparent material to facilitate observation of the blood flow color and pulsatile flow.

[0038] As shown in FIG. 3C, once vascular access has been confirmed, the needle hub 112 can be withdrawn proximally to withdraw the tip 116 proximally of the distal tip of the catheter 120. In an embodiment, the needle 110 can be withdrawn further, for example, so that the needle tip 116 is proximal of one of the access section 162, dilation section 164, the catheter body section 166, the hub 168, the bifurcation 170, or withdrawn from the catheter 120 entirely.

[0039] As shown in FIG. 3D, a user can then slide the catheter advancement assembly 136 and the catheter 120, coupled thereto, from the proximal position to the medial position to advance the catheter 120 into the insertion site 90. As the dilation section 164 is urged into the insertion site 90, the insertion site 90 is dilated to the second diameter of the catheter body section 166. To note, the catheter body section 166 can include two or more lumen that each

communicate with an opening disposed in a side wall of the catheter body section 166 adjacent the dilation section 164.

[0040] When the catheter advancement assembly 136 is advanced to the medial position (FIG. 3D) the distal support 134 can slide distally from the housing body 132 (FIG. 3E) from the retracted position to the extended position. In an embodiment, the catheter advancement assembly 136 can be advanced to the medial position simultaneously with the distal support 134 being advanced to the extended position. Advantageously, the simultaneous advancement of the catheter advancement assembly 136 and the distal support 134 allows the nose portion 180 to provide rigid support to the catheter 120 as the catheter 120 is advanced. In an embodiment, with the distal support 134 in the extended position, the catheter advancement assembly 136 can advance from the medial position (FIG. 3D) to the distal position (FIG. 3E). Advantageously, the catheter advancement assembly 136 and the distal support 134 can be selectively advanced by the user to advance the catheter 120 and provide support to the catheter 120 to prevent buckling or kinking of the catheter 120 without having to directly touch portions of the catheter 120 that are to enter the patient's body.

[0041] In an embodiment, the system 100 can include one or more gears, levers, or similar mechanisms to provide mechanical advantage between the longitudinal movement of one or both of the distal support 134 and the catheter advancement assembly 136 and the resulting movement of one or both of the nose portion 180 and the catheter 120. For example, as shown in FIGS. 3C-3E, a 1:1 mechanical advantage is shown where for a single unit of longitudinal distance of user input, a single unit of longitudinal distance of output is achieved, i.e. 1cm of distal support handle 178 movement results in 1cm of nose portion 180 movement. Similarly, 1cm of catheter advancement assembly 136 movement results in 1cm of catheter 120 movement. In an embodiment, the system 100 can include mechanisms to provide a 1:>1 mechanical advantage, i.e. 1cm of distal support handle 178 movement results in >1cm of nose portion 180 movement. Similarly, 1cm of catheter advancement assembly 136 movement results in >1cm of catheter 120 movement.

[0042] FIGS. 3F-3G show close up detail of an underside view of the system 100. In an embodiment, as shown in FIGS. 3F-3G, the catheter advancement assembly 136 can include an abutment surface 174 configured to engage a cam surface 176 of the housing body 132. As the catheter advancement assembly 136 transitions from the medial position (FIG. 3F) to the distal position, the abutment surface 174 can engage the cam surface 176 to urge two or more

portions 132A, 132B of the housing body 132 laterally apart. Separating the housing portions 132A, 132B can provide a longitudinal opening to allow the housing body 132 to disengage the catheter 120 in a transverse direction, as described in more detail herein. FIG. 3G shows an underside view of the system 100 with the catheter advancement assembly 136 in the distal position and the distal support 134 in the extended position.

[0043] As shown in FIGS. 3H-3J, with the distal support 134 in the extended position and the catheter advancement assembly 136 in the distal position, the catheter 120 is placed within the vasculature with the catheter hub 168 is disposed adjacent the insertion site 90. Advantageously, the user can place the catheter 120 as such without having to directly touch the catheter 120 distally of the catheter hub 168. Once the catheter 120 is placed, the door 138 of the nose piece 180 can rotate to an open position to allow the nose piece 180 to disengage the catheter 120 (FIGS. 3H, 3I). In an embodiment, as shown in FIG. 3H, the system 100 can include a first door 138A and a second door 138, each configured to rotate relative to the housing 130. In an embodiment, the door(s) 138 through a longitudinal axis, either through a vertical plane, a horizontal plane, or at an angle relative thereto. In an embodiment, as shown in FIG. 3I, a first door 138A can rotate relative to a second door 138B, the second door 138B remaining stationary relative to the housing 130. In an embodiment, the door 138 can rotate through an axis extending perpendicular to the longitudinal axis, e.g. a lateral vertical plane. These and other number, orientation, or configuration of doors 138 are contemplated to fall within the scope of the present invention. As shown in FIG. 3J, the housing 130 can then disengage the catheter 120 transversely upward, leaving the catheter 120 placed within the vasculature of the patient. Advantageously, the catheter placement system 100 can place the catheter 120 while maintaining axial support to prevent buckling and can prevent the user from touching any portion of the catheter.

[0044] 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.

CLAIMS

What is claimed is:

1. A catheter placement system, comprising:
a needle supported by a needle hub;
a catheter defining a catheter lumen, the needle extending through a portion of the catheter lumen; and
a housing comprising:
a body;
a catheter advancement assembly releasably engaged with a hub of the catheter, the catheter advancement assembly slidably engaged with the body between a proximal position, a medial position, and a distal position; and
a distal support slidably engaged with the body between a retracted position and an extended position, the distal support including a nose portion defining a channel to receive a portion of the catheter therethrough.
2. The catheter placement system according to claim 1, wherein the distal support is configured to transition the catheter assembly from the proximal position to the medial position as the distal support is transitioned from the retracted position to the extended position.
3. The catheter placement system according to any one of claims 1-2, wherein the catheter advancement assembly is configured to transition the distal support from the retracted position to the extended position as the catheter advancement assembly is transitioned from the medial position to the distal position.
4. The catheter placement system according to any one of claims 1-3, wherein the catheter advancement assembly includes an abutment and the body includes a cam surface, the abutment configured to engage the cam surface to urge a first portion of the body laterally apart from a second portion of the body, as the catheter advancement assembly is transitioned from the medial position to the distal position.
5. The catheter placement system according to any one of claims 1-4, wherein the nose portion includes a door hingedly engaged therewith, and rotatable to an open position to allow egress of the portion of the catheter from the channel.

6. The catheter placement system according to any one of claims 1-5, wherein the distal support is configured to extend distally from the housing to maintain the nose portion within a predetermined distance from a tip of the needle.
7. The catheter placement system according to claim 6, wherein the predetermined distance is a needle bending arm length of 7 cm or less.
8. The catheter placement system according to any one of claims 1-7, further including a blood flash indicator configured to receive a blood flow from the needle lumen.
9. The catheter placement system according to any one of claims 1-8, wherein the catheter is a CVC catheter or a RICC catheter.
10. A method of placing a catheter within a vasculature of a patient, comprising:
 - accessing the vasculature with a needle, the needle extending from a housing and including a portion of the catheter disposed annularly thereon;
 - sliding a catheter advancement assembly from a proximal position to a medial position to advance a portion of the catheter into the vasculature;
 - actuating a distal support from a retracted position to an extended position;
 - advancing the catheter advancement assembly from the medial position to a distal position;
 - separating a first portion of the housing laterally apart from a second portion of the housing; and
 - disengaging the housing transversely upward from the catheter.
11. The method according to claim 10, wherein the catheter advancement assembly includes an abutment configured to engage a cam surface of the housing body to separate the first portion of the housing laterally apart from the second portion of the housing, as the catheter advancement assembly transitions from the medial position to the distal position.
12. The method according to any one of claims 10-11, wherein the distal support includes a nose portion defining a channel and is slidably engaged with the catheter, the nose portion providing rigid columnar support to a portion of the catheter as the catheter advancement assembly transitions from the medial position to the distal position.

13. The method according to claim 12, wherein the nose portion includes a door hingedly coupled thereto and configured to transition from a closed position to an open position to allow egress of the catheter from the channel along an axis perpendicular to a longitudinal axis.

14. The method according to any one of claims 10-13, further comprising withdrawing a needle proximally, prior to advancing the catheter advancement assembly from the proximal position.

15. The method according to any one of claims 10-14, wherein the catheter advancement assembly releasably engages a portion of the catheter in an interference fit, press-fit, or snap-fit engagement.

16. The method according to any one of claims 12-15, further comprising extending the distal support distally from the housing to maintain the nose portion within a predetermined distance from a tip of the needle.

17. The method according to claim 16, wherein the predetermined distance is a needle bending arm length of 7 cm or less.

18. The method according to any one of claims 10-17, further comprising sliding a blood flash indicator along a longitudinal axis to create a vacuum and draw a blood flow through a lumen of the needle.

19. The method according to any one of claims 10-18, wherein the catheter is a CVC catheter or a RICC catheter.