

defective, non-stenotic (non-calcified) native valve, although they also can be used to replace stenotic valves. One drawback associated with implanting a self-expanding prosthetic valve is that as the operator begins to advance the prosthetic valve from the open end of the delivery sheath, the prosthetic valve tends to “jump” out very quickly from the end of the sheath; in other words, the outward biasing force of the prosthetic valve’s frame tends to cause the prosthetic valve to be ejected very quickly from the distal end of the delivery sheath, making it difficult to deliver the prosthetic valve from the sheath in a precise and controlled manner and increasing the risk of trauma to the patient.

[005] Another problem associated with implanting a percutaneous prosthetic valve in a non-stenotic native valve is that the prosthetic valve may not be able to exert sufficient force against the surrounding tissue to resist migration of the prosthetic valve. Typically, the stent of the prosthetic valve must be provided with additional anchoring or attachment devices to assist in anchoring the prosthetic valve to the surrounding tissue. Moreover, such anchoring devices or portions of the stent that assist in anchoring the prosthetic valve typically extend into and become fixed to non-diseased areas of the vasculature, which can result in complications if future intervention is required, for example, if the prosthetic valve needs to be removed from the patient.

SUMMARY

[006] Certain embodiments of the present disclosure provide a prosthetic valve (*e.g.*, a prosthetic heart valve) and a valve delivery apparatus for delivery of the prosthetic valve to a native valve site via the human vasculature. The delivery apparatus ~~is~~ can be particularly suited for advancing a prosthetic valve through the aorta (*i.e.*, in a retrograde approach) for replacing a diseased native aortic valve. The delivery apparatus in particular embodiments is configured to deploy a prosthetic valve from a delivery sheath in a precise and controlled manner at the target location within the body.

[007] In an aspect, a prosthetic valve delivery assembly comprises a prosthetic valve, an elongate shaft located proximal to the prosthetic valve, a suture-retention member located distal to the shaft, at least one ~~a~~ slidable release member, a plurality of suture loops extending from the proximal portion of the suture-retention member, and an outer sheath. The prosthetic valve can comprise

a self-expandable stent having a plurality of apices spaced circumferentially around a first end portion of the stent, wherein each apex has an aperture. The suture-retention member can comprise a proximal portion and a distal portion spaced from the proximal portion, the proximal portion being coupled to the shaft. The at least one slidable release member can extend through the proximal portion and the distal portion of the suture-retention member and a plurality of suture loops extending from the proximal portion of the suture-retention member. The plurality of suture loops can extend through the apertures in the apices of the stent and around the release member at a location between the proximal and distal portions of suture-retention member, such that at least one of the suture loops extends through the aperture of every apex. The outer sheath can be advanced over the prosthetic valve to retain the prosthetic valve in a radially compressed state, and can be retracted relative to the prosthetic valve to permit radial expansion of the prosthetic valve while the stent remains connected to the suture-retention member via the suture loops. After the entirety of the prosthetic valve is deployed from the sheath, the sheath can be advanced distally back over the prosthetic valve to cause the prosthetic valve to radially collapse as it is recaptured by the sheath.

[008] In some embodiments, the suture loops are formed from a single length of suture material.

[009] In some embodiments, the shaft comprises a first shaft and the assembly further comprises a second shaft extending at least partially through the first shaft, wherein the outer sheath can be advanced or retracted relative to the prosthetic valve by rotating the second shaft relative to the first shaft.

[010] In some embodiments, the at least one release member is slidable relative to the suture-retention member, and when the release member is retracted proximally such that a distal end of the release member is proximal to the distal portion of the suture-retention member, the suture loops can slide off the distal end of the release member, thereby releasing the prosthetic valve from the suture-retention member.

[011] In some embodiments, at least a portion of the outer sheath comprises a slotted metal tube.

[025] ~~In another aspect~~ There is also disclosed, a method for delivering a prosthetic valve to the aortic annulus of the heart comprises inserting an elongated delivery apparatus into a femoral artery of a patient, the delivery apparatus comprising a delivery sheath containing the prosthetic valve in a radially compressed state. The method can further comprise advancing the delivery apparatus through the aorta until the prosthetic valve is at an implantation location within the aortic annulus, wherein when the prosthetic valve is at the implantation location, the delivery sheath extends through the ascending aorta and the aortic arch, and a proximal end of the delivery sheath is within the descending aorta. The method can further comprise retracting the delivery sheath relative to the prosthetic valve to deploy the prosthetic valve from a distal end of the delivery sheath.

[026] ~~In some embodiments~~ Preferably, the delivery sheath is at least about 3–5 cm and no greater than 40 cm in length.

[027] Preferably ~~In some embodiments~~, the delivery sheath comprises a distal end portion and a proximal end portion that is more flexible than the distal end portion. The distal end portion of the sheath can extend over and retain the prosthetic valve in the radially compressed state during the acts of the inserting and advancing the delivery apparatus, and the proximal end portion can extend through the ascending aorta, the aortic arch and into the descending aorta when the prosthetic valve is at the implantation location.

[028] Preferably ~~In some embodiments~~, the prosthetic valve is releasably secured to the delivery apparatus via a plural of suture loops.

[029] Preferably ~~In some embodiments~~, the act of retracting the delivery sheath comprises deploying the entire prosthetic valve from the delivery sheath and allowing the prosthetic valve to radially expand while still secured to the delivery apparatus via the suture loops.

[030] Preferably ~~In some embodiments~~, the method further comprises, after deploying the entire prosthetic valve from the delivery sheath, recapturing the prosthetic valve by advancing the delivery sheath distally back over the prosthetic valve.

[031] There is also disclosed ~~In another aspect~~, a method for delivering a prosthetic valve to a native valve annulus of the heart comprises inserting an elongated delivery apparatus into the