

shape and/or in conformance to the shape and dimension of the patent foramen ovale being treated. With the distal end of catheter 42 positioned in the left atrium, adjacent to the patent foramen ovale, embolic filtering device 10 is withdrawn from catheter 42, while catheter 42 is slowly pulled back through the patent foramen ovale in the direction of the right atrium. Left anchors 26 are withdrawn first, and as catheter 42 is pulled back, left anchors 26 are caused to securely engage the walls defining the patent foramen ovale, preferably, the tissue defining the perimeter of the left-atrial opening 23 of the patent foramen ovale, as shown in FIG. 5C. As catheter 42 is pulled back further, the engagement of left anchors 26 onto the tissue defining the perimeter of the left-atrial opening 23 of arms 20 and 22 will prevent embolic filter device 10 from being pulled through the patent foramen ovale, and embolic filter 14 will emerge preferably within the patent foramen ovale, and will gradually expand apart from one another in returning to the shape memorized orientation. As arms 20 and 22 expand apart from one another, pressure will be exerted onto the tissue defining the lumen of the patent foramen ovale, thereby acting as a tissue distension device. The tissue defining the patent foramen ovale will naturally press inward against mesh 14, in effect squeezing the device within the patent foramen ovale. As catheter 42 is pulled back yet further, right anchors 24 will emerge and, as they expand to their memorized shape, will also forcibly engage, for example, the walls defining the patent foramen ovale, or the perimeter of the tissue defining right atrial opening 27 of the patent foramen ovale. If using the embolic filter device illustrated in FIG. 5A, for example, right anchors 24 will engage the tissue defining the outside perimeter defining the right-atrial opening 27 of the patent-foramen ovale, as illustrated in FIG. 5B. In its memorized shape, embolic filter 14 should be sized to engage the walls defining the patent foramen ovale with sufficient force to prevent emboli from passing between the exterior of the embolic filter 14 and the walls of defining the patent foramen ovale. Further, the force created from blood flowing from the right atrium to the left atrium against right anchors 24 facilitates the securing of right anchors 24, and helps prevent embolic filtering device 10 from becoming dislodged from its intended position.

[0049] It will be recognized by those of ordinary skill, that the device can further be secured in place by adhesives, sutures, hooks, barbs, or other such means. To enhance recovery subsequent to implanting embolic filtering device 10 frame 12 and/or mesh 14 can be coated with known drugs suitable for that purpose. Non-pharmacological methods can also be used to promote healing, including ultrasound, radiofrequency, radiation, mechanical vibration, or any other known non-pharmacological healing method.

[0050] Prior to disengaging embolic filtering device 10 from forceps 44 and removing catheter 42 from the subject, known radiological techniques can be employed to insure that embolic filtering device 10 is properly positioned and secured within the patent foramen ovale. If the position of embolic filtering device 10 needs to be altered, forceps 44, while still secured to embolic filtering device 10, can be used to reposition embolic filtering device 10; otherwise, forceps 44 are disengaged from embolic filtering device 10, and forceps 44, catheter 42, and guide wire 40 are withdrawn. Should embolic filter device 10 later become disengaged, disoriented, damaged or otherwise need to be removed, forceps 44 can be used to easily reposition or recover

embolic filter device 10, as necessary. To facilitate the ease by which embolic filter device 10 is repositioned or recovered, base 16 is preferably coated with a suitable material to deter tissue from covering recess 46.

[0051] From the moment that embolic filtering device 10 is inserted, emboli are effectively filtered by embolic filtering device 10. Since blood travels from the direction of the right atrium to the left atrium, the portion of embolic filter 14 having a higher density of mesh, e.g., lobes 29 and/or interior embolic filter portion 34, are positioned on the right atria side to decrease the chances that emboli will penetrate into the left atrium. The design of embolic filtering device 10, however, is such that if emboli pass through the right side of embolic filter 14, there is still a significant chance that the portion of embolic filter 14 positioned on the left atrial side will prevent the emboli from passing into the left atrium.

[0052] Thus, unlike known devices for treating patent foramen ovale or atrial septal defects, for example, it is not necessary for thrombi to collect on the embolic filtering device 10 before the passage of emboli are effectively deterred. However, if total occlusion of the passage is desired, embolic filtering device 10 the embolic filter 14 can be treated with materials to promote thrombosis, tissue in-growth, or adhesions. Embolic filter 14 can also be treated with anticoagulants to discourage blood clot formation on the device 10.

[0053] The primary function of frame 12 is to facilitate the delivery, positioning and securing of the embolic filter 14 within and/or adjacent to a passage between a venous blood pool and an arterial blood pool. It should be appreciated, however, that embolic filter 14 can be employed by itself, without frame 12, by securing embolic filter 14 by other means, e.g. sutures, hooks, etc., to deter the passage of emboli through a passage between a venous blood pool and an arterial blood pool. Further, embolic filter 14 can be of virtually any shape, spherical, round, oval or flat, so long as it retains its ability to filter emboli.

[0054] In another aspect of the invention, as exemplified in FIGS. 6A and 6B, provided is an embolic filter device 100 composed of a mesh 112 and a frame 114, to which mesh 112 is attached. Mesh 112 can be composed of any suitable material, including fabric, metal (e.g. shape memory metal or non-shape memory metal), or polymer, and can be of any shape (e.g., round, oval, or flat) or size suitable for the opening to be treated. Frame 114 can also be composed of any suitable material. For example, frame 114 can be composed of fabric, if rigidity is not required to support the opening to be treated. Alternatively, frame 114 can be composed of plastic, metal or the like, so as to act as a stent to give support to the orifice through which the passage of embolic is to be deterred. Depending on the particular use, mesh 112 and/or frame 114 can be absorbable or non-absorbable. To deter the passage of emboli from a passage between a venous blood pool and an arterial blood pool, embolic filtering device 110 is preferably used to block the passage between a venous blood pool and an arterial blood pool. Using the example of a patent foramen ovale, embolic filtering device 100 can be attached to tissue adjacent to the patent foramen ovale by for example, sutures, barbs, hooks, glue, or any other suitable attaching means 116 to, in effect, create a screen covering the right atrial and/or left atrial