SUMMARY

The present disclosure~~invention~~ is directed to apparatus for removing material within a body lumen of a patient. More particularly, the present disclosure~~invention~~ is directed to apparatus for removing or otherwise capturing thrombus or other obstructive material within a tubular graft, blood vessel, or other body lumen, e.g., by cutting, separating, and/or aspiration the material, and to methods for making and using such apparatus.

In accordance with a first aspect~~embodiment~~, an apparatus is provided for removing material within a body lumen that includes ~~an elongate~~ tubular member including a proximal end, a distal end sized for introduction into a body lumen, and an aspiration lumen extending between the proximal and distal ends; a guide member extending from the distal end and terminating in a distal tip, the guide member comprising a track adjacent a track lumen extending from the distal tip into the aspiration lumen; and an obstruction clearing device deployable from the guide member and retractable along the track.

~~In an exemplary embodiment, t~~The obstruction clearing member includes a core wire slidable within the track lumen and one or more lumen clearing elements deployable from the distal tip of the guide member when the core wire is advanced relative to the guide member. The lumen clearing element(s) may include an expandable structure that is expanded from a contracted condition within the guide member to an expanded condition when deployed from the guide member~~, e.g.,~~ for engaging material within a body lumen. The expandable structure may be directable proximally along the track in the expanded condition~~, e.g.,~~ when the core wire is subsequently retracted relative to the guide member, for drawing the lumen clearing element(s) and any captured material into the aspiration lumen of the tubular member.

In addition, the guide member may include an orifice, e.g., in a side wall thereof, communicating with the track lumen, the orifice located within the aspiration lumen such that, when the core wire is retracted relative to the guide member, the expandable structure is compressed inwardly towards the contracted condition and the lumen clearing element(s) are drawn through the orifice into the track lumen. For example, the lumen clearing element(s) may be oriented substantially axially within the track lumen when the one or more lumen clearing elements are drawn through the orifice into the track lumen. When the core wire is subsequently advanced relative to the guide member, the lumen clearing element(s) may be directed through the track lumen in the contracted condition until the lumen clearing element(s) are redeployed from the distal tip of the guide member.

introduced into a body lumen, the tubular member including an aspiration lumen and a cutting head disposed within the aspiration lumen near the distal end. The tubular member may be positioned such that the distal end is disposed adjacent material to be removed and/or vacuum pressure may be applied to the aspiration lumen to draw material within the body lumen towards the distal end of the tubular member. The cutting head may be activated, e.g., before, after, or when the vacuum pressure is applied, to cause the cutting head to reciprocate relative to the distal end to macerate material drawn to the distal end of the tubular member. The cutting head may break the material into pieces sufficiently small to be aspirated into the aspiration lumen by the vacuum pressure.

Other aspects and features of the present disclosure~~invention~~ will become apparent from consideration of the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

It will be appreciated that the exemplary apparatus shown in the drawings are not necessarily drawn to scale, with emphasis instead being placed on illustrating the various aspects and features of the illustrated embodiments.

FIG. 1 is a side view of a distal end of an exemplary embodiment of an apparatus for capturing material within a body lumen, the apparatus including a plurality of lumen clearing elements deployable along a track of a catheter.

FIG. 2 is a cross-sectional view of a body lumen, showing the apparatus of FIG. 1 positioned therein with the lumen clearing elements deployed from the track within the body lumen.

FIGS. 3A-3G are cross-sectional views of a body lumen showing a method for capturing material from the body lumen using the apparatus of FIGS. 1 and 2.

FIG. 4 is a side view of a distal end of another exemplary embodiment of an apparatus for capturing material from within a body lumen that includes an alternate configuration for a lumen clearing element.

FIG. 5 is a side of an exemplary embodiment of another apparatus for capturing material within a body lumen that includes a reciprocating cutting head deployable from a catheter.

FIGS. 6A-6D are cross-sectional views of a body lumen showing a method for capturing material within the body lumen using the apparatus of FIG. 5.