CLAIMS

1. A system for forming an anastomosis in a heart, comprising:

a first catheter comprising an electrode; and

a second catheter slidably disposed within the first catheter, the second catheter comprising a barb and a dilator comprising a mating surface configured to engage the electrode.

2. The system of claim 1, wherein the barb is disposed within a lumen of the electrode when the mating surface engages the electrode.

3. The system of claim 1, wherein an outer diameter of the dilator is less than an outer diameter of the electrode.

~~4. The system of claim 1, wherein the barb is configured to engage tissue.~~

~~5~~4. The system of claim 1, wherein the second catheter defines a longitudinal axis, wherein the barb comprises at least one projection comprising a first portion and a second portion, the first portion angled relative to the second portion.

~~6~~5. The system of claim ~~5~~4, wherein a length of the first portion to a length of the second portion is in a ratio between about 2:3 and about 1:5.

~~7~~6. The system of claim ~~5~~4, wherein the second portion comprises a length between about 0.1 mm and about 2 cm.

~~8. The system of claim 5, wherein the second catheter defines a longitudinal axis, and the first portion is angled between about 60 degrees and about 120 degrees relative to the longitudinal axis.~~

~~9. The system of claim 8, wherein the first portion is substantially perpendicular to the longitudinal axis.~~

~~10. The system of claim 5, wherein the second portion is angled up to about 30 degrees relative to the longitudinal axis.~~

~~11. The system of claim 10, wherein the second portion is substantially parallel to the longitudinal axis.~~

~~12. The system of claim 1, wherein the barb comprise between about 3 projections and about 7 projections.~~

~~13. The system of claim 5, wherein at least one projection comprises one of an "L" shape, "J" shape, and "C" shape.~~

~~14. The system of claim 5, wherein at least one projection comprises a plurality of projections configured in a set of concentric rings.~~

~~15. The system of claim 5, wherein at least one projection is configured to penetrate through tissue.~~

~~16. The system of claim 1, wherein the second catheter defines a longitudinal axis, and the barb comprises at least one projection angled between about 5 degrees and about 60 degrees relative to the longitudinal axis.~~

~~17~~7. The system of claim 1, wherein a length of the barb is between about 0.1 mm and about 5 cm.

~~18~~8. The system of claim 1, wherein the electrode and the mating surface are configured to compress tissue therebetween.

~~19~~9. The system of claim 1, wherein the second catheter defines a longitudinal axis, and the mating surface is non-perpendicular and non-parallel to the longitudinal axis.

~~20. The system of claim 1, wherein the first catheter comprises an insulator disposed over a portion of the electrode.~~

~~21. The system of claim 1, wherein the insulator comprises a fluoropolymer material.~~

~~22. The system of claim 1, wherein a distal surface of the electrode and at least a portion of an inner diameter of the electrode are uninsulated.~~

~~23. The system of claim 1, wherein the electrode is proximal to the dilator.~~

~~24. The system of claim 1, wherein the first catheter defines a vent lumen.~~

~~25. The system of claim 1, further comprising a signal generator configured to generate a biphasic waveform, the signal generator coupled to the electrode.~~

~~26. The system of claim 1, wherein the barb defines a longitudinal axis, and the barb is configured to rotate about the longitudinal axis.~~

~~27. The system of claim 26, wherein the barb is configured to rotate up to about 360 degrees about the longitudinal axis.~~

~~28. The system of claim 1, wherein the dilator defines a recess configured to hold the barb.~~

~~29. The system of claim 28, wherein the barb is arranged inside the recess in a first configuration and at least a portion of the barb is arranged outside the recess in a second configuration.~~

~~30. The system of claim 28, wherein a length of the recess is at least equal to a length of the barb.~~

~~31. The system of claim 29, wherein the barb is configured to translate relative to the dilator to transition between the first configuration and the second configuration.~~

~~32~~10. The system of claim 1, wherein the dilator comprises a fluid port configured to output a contrast agent.

~~33. The system of claim 32, wherein a proximal portion of the dilator comprises the fluid port.~~

~~34. The system of claim 32, wherein the fluid port is configured to receive the contrast agent from a lumen of the electrode.~~

~~35~~11. The system of claim 1, wherein the first catheter comprises a contrast agent lumen.

~~36. The system of claim 1, wherein the first catheter is configured to output a contrast agent.~~

~~37. The system of claim 36, wherein the contrast agent is output into a lumen of the electrode.~~

~~38~~12. The system of claim 1, wherein the electrode comprises a fluid port configured to output a contrast agent.

~~39. The system of claim 38, wherein a distal end of the electrode comprises the fluid port.~~

~~40. The system of claim 1, wherein the dilator comprises an echogenic region.~~

~~41. The system of claim 40, wherein the echogenic region comprises one or more recesses or protrusions.~~

~~42~~13. The system of claim ~~41~~1, wherein the dilator comprises an echogenic region comprising one or more recesses or protrusions ~~comprise~~ comprising a diameter of between about 5 µm and about 100 µm.

~~43. The system of claim 41, wherein the echogenic region comprises a recess and protrusion density of between about 5% and about 50%.~~

~~44. The system of claim 40, wherein the dilator comprises one or more microspheres.~~

~~45. The system of claim 44, wherein the one or more microspheres comprise a gas core.~~

~~46. The system of claim 44, wherein the one or more microspheres comprise glass.~~

~~47. The system of claim 40, wherein the echogenic region is on a surface of the dilator.~~

~~48. The system of claim 40, wherein the echogenic region is below a surface of the dilator.~~

~~49~~14. The system of claim 1, further comprising a first catheter actuator configured to deflect a distal portion of the first catheter, the first catheter actuator electrically coupled to the electrode.

~~50. The system of claim 1, wherein a proximal end of the first catheter actuator is configured to couple to an actuation mechanism.~~

~~51. The system of claim 1, wherein the first catheter actuator comprises a pull wire extending along a length of the first catheter.~~

~~52. The system of claim 49, wherein the distal portion of the first catheter comprises a predetermined bend.~~

~~53. The system of claim 52, wherein the predetermined bend comprises an angle between about 30 degrees and about 70 degrees.~~

~~54~~15. The system of claim 1, wherein the mating surface defines a recess configured to receive a distal end of the electrode.

~~55~~16. The system of claim ~~54~~15, wherein the electrode is configured to electrically short when the electrode engages the recess of the mating surface.

~~56. The system of claim 1, wherein the mating surface comprises a deformable material.~~

~~57. The system of claim 1, wherein the mating surface comprises a non-conductive portion.~~

~~58. The system of claim 57, wherein the non-conductive portion comprises one or more of a polymer, ceramic, and aluminum oxide.~~

~~59~~17. The system of claim 1, wherein the mating surface comprises a conductive portion.

~~60~~18. The system of claim 1, wherein a proximal portion of the dilator is arranged within a lumen of the electrode when the mating surface engages the electrode.

~~61. The system of claim 60, wherein between about 0.5 mm and about 2 mm of the proximal portion of the dilator is disposed within the lumen of the electrode when the mating surface engages the electrode.~~

~~62. The system of claim 1, further comprising a signal generator configured to generate a first waveform followed by a second waveform, the signal generator coupled to the electrode, the first waveform comprising a first voltage and the second waveform comprising a second voltage, and the first voltage higher than the second voltage.~~

~~63. A method of forming an anastomosis in a heart, comprising:~~

~~advancing a first and second catheter into a right atrium, wherein the first catheter comprises an electrode defining a lumen and the second catheter comprises a dilator and a barb;~~

~~advancing the second catheter into a left atrium through an interatrial septum such that the first catheter is in the right atrium;~~

~~withdrawing the second catheter towards the first catheter to engage a first portion of the septum to the barb, withdraw the first portion into the lumen, and compress a second portion of the septum between the electrode and the dilator; and~~

~~delivering an ablation waveform to the electrode to cut the second portion such that the first portion is held within the lumen.~~

~~64. The method of claim 63, wherein withdrawing the second catheter towards the first catheter comprises withdrawing the barb into the lumen.~~

~~65. The method of claim 64, wherein a size of the first portion cut from the second portion corresponds to a distance the barb is withdrawn into the lumen.~~

~~66. The method of claim 63, wherein withdrawing the second catheter towards the first catheter stretches the first portion.~~

~~67. The method of claim 63, wherein the first portion of the septum forms a substantially cylindrical shape when withdrawn into the lumen.~~

~~68. The method of claim 63, wherein the first portion of the septum engaged to the barb is intact when withdrawn into the lumen.~~

~~69. The method of claim 63, wherein the barb pierces through the first portion when withdrawing the second catheter towards the first catheter.~~

~~70. The method of claim 67, wherein an anastomosis comprising a diameter between about 1 mm and about 1.5 cm is formed in response to delivering the ablation waveform.~~

~~71. The method of claim 63, wherein the first portion forms a substantially conical or cylindrical shape when engaged by the barb.~~

~~72. The method of claim 63, wherein the first portion is engaged by the barb at least during delivery of the ablation waveform.~~

~~73. The method of claim 67, wherein the first portion is engaged by the barb after delivering the ablation waveform to the electrode.~~

~~74. The method of claim 63, wherein the second portion is compressed with a force of at least 20 grams.~~

~~75. The method of claim 63, further comprising electrically shorting the electrode when the electrode contacts the dilator during delivery of the ablation waveform.~~

~~76. The method of claim 63, wherein the ablation waveform comprises a two-phase waveform.~~

~~77. The method of claim 63, further comprising fluoroscopically imaging a radiopaque portion of one or more of the first and second catheters during one or more steps.~~

~~78. The method of claim 63, wherein engaging the first portion of the septum to the barb comprising rotating the barb about a longitudinal axis of the barb.~~

~~79. The method of claim 78, wherein a size of the first portion corresponds to a rotation angle of the barb.~~

~~80. The method of claim 78, wherein rotating the barb comprises a rotation angle of up to about 360 degrees.~~

~~81. The method of claim 63, wherein withdrawing the second catheter towards the first catheter comprises translating the barb relative to the dilator to engage the first portion of the septum.~~

~~82. The method of claim 63, wherein withdrawing the second catheter towards the first catheter comprises withdrawing the barb away from the dilator.~~

~~83. The method of claim 63, wherein withdrawing the second catheter towards the first catheter comprises transitioning from a first configuration where the barb is arranged inside a recess of the dilator to a second configuration where the barb is arranged outside the recess.~~

~~84. The method of claim 63, further comprising introducing a contrast agent into the heart via a fluid port in the dilator.~~

~~85. The method of claim 63, further comprising introducing a contrast agent into a lumen of the electrode.~~

~~86. The method of claim 63, further comprising receiving ultrasound waves from a distal end of the ablation device.~~

~~87. The method of claim 86, wherein the distal end of the ablation device comprises one or more microspheres comprising a diameter of between about 5 μm and about 100 μm.~~

~~88. The method of claim 63, wherein withdrawing the second catheter towards the first catheter deforms a proximal portion of the dilator.~~

~~89. The method of claim 63, wherein withdrawing the second catheter towards the first catheter comprises engaging the electrode to a mating surface of the second catheter.~~

~~90. The method of claim 89, wherein compressing the second portion of the septum comprises a distal end of the electrode and a mating surface of the dilator.~~

~~91. The method of claim 63, wherein the second portion is compressed with a force of up to about 25 N.~~

~~92. The method of claim 63, wherein the ablation waveform comprises a first waveform followed by a second waveform, the first waveform comprising a first voltage and the second waveform comprising a second voltage, and the first voltage higher than the second voltage.~~

~~93. The system of claim 1, wherein a proximal portion of the dilator comprises a first step portion comprising a first diameter and a second step portion comprising a second diameter greater than the first diameter, the first step portion proximal to the second step portion.~~

~~94. The system of claim 93, wherein the second step comprises the mating surface configured to engage a distal end of the electrode.~~

~~95. The system of claim 94, wherein the mating surface is substantially perpendicular to a longitudinal axis of the dilator.~~

~~96. The system of claim 93, wherein the first step is configured to engage a sidewall of the electrode when the dilator engages the electrode.~~

~~97. The system of claim 93, wherein the dilator is configured to attach to the first catheter when the dilator engages the electrode.~~

~~98~~19. A system for forming an anastomosis in a heart, comprising:

a first catheter comprising an electrode; and

a second catheter slidably disposed within the first catheter, the second catheter comprising a barb and a dilator, wherein a proximal portion of the dilator comprises a first step portion comprising a first diameter and a second step portion comprising a second diameter greater than the first diameter, the first step portion proximal to the second step portion.

~~99~~20. A system for forming an anastomosis in a heart, comprising:

a first catheter comprising an electrode; and

a second catheter slidably disposed within the first catheter, the second catheter comprising a barb and a dilator, wherein the barb is enclosed within a lumen of the electrode when the dilator engages the electrode.

~~100. A system for forming an anastomosis in a heart, comprising:~~

~~a first catheter comprising an electrode; and~~

~~a second catheter slidably disposed within the first catheter, the second catheter comprising a barb and a dilator, the system configured to compress tissue between the electrode and the dilator with a first predetermined force.~~

~~101. The system of any one of claims 1-62 and 93-100, wherein the dilator is configured to shear the tissue with a second predetermined force greater than the first predetermined force.~~

~~102. The system of claim 101, wherein the first predetermined force is up to about 25 N.~~

~~103. The system of claim 103, wherein the second predetermined force is more than about 25 N.~~