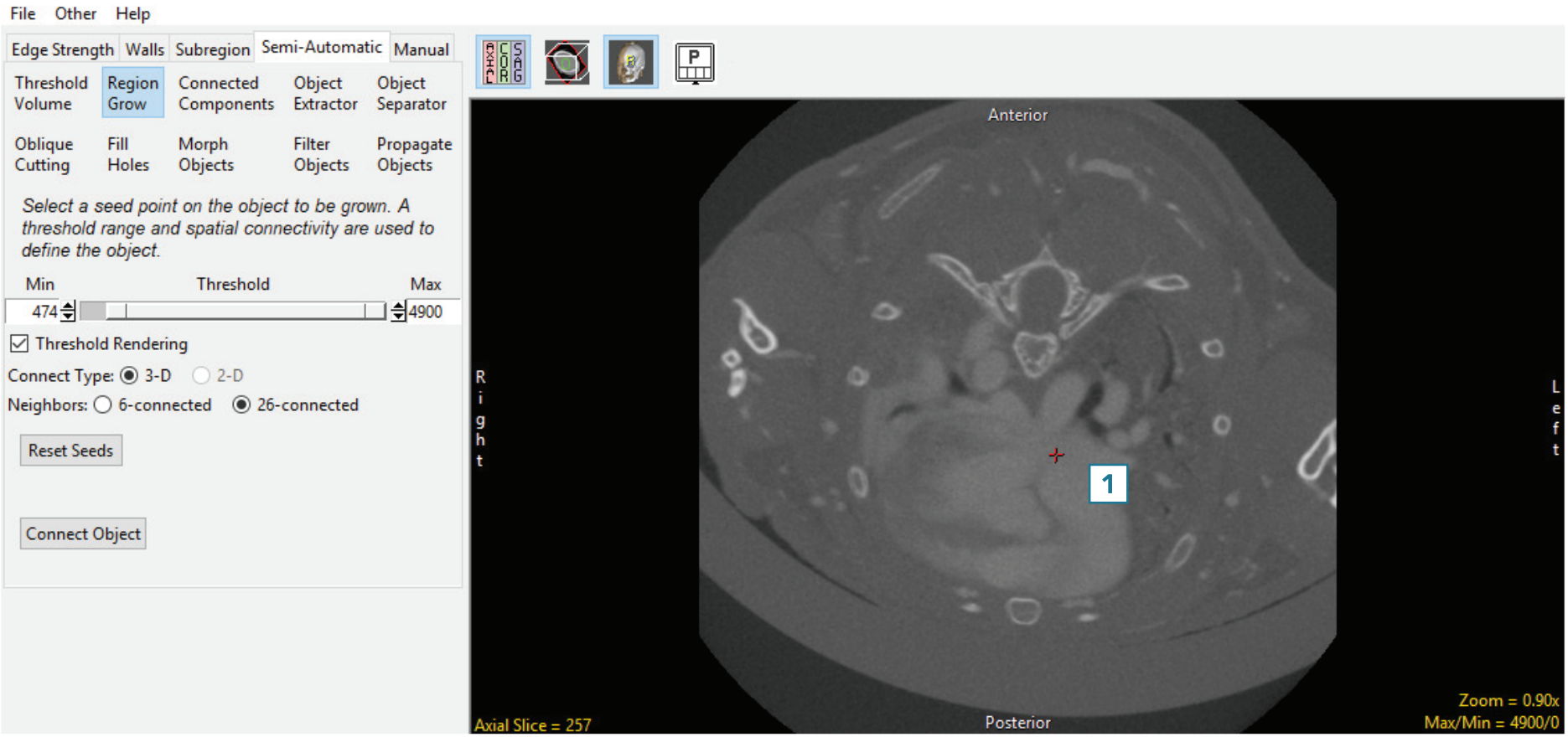
# Region Grow

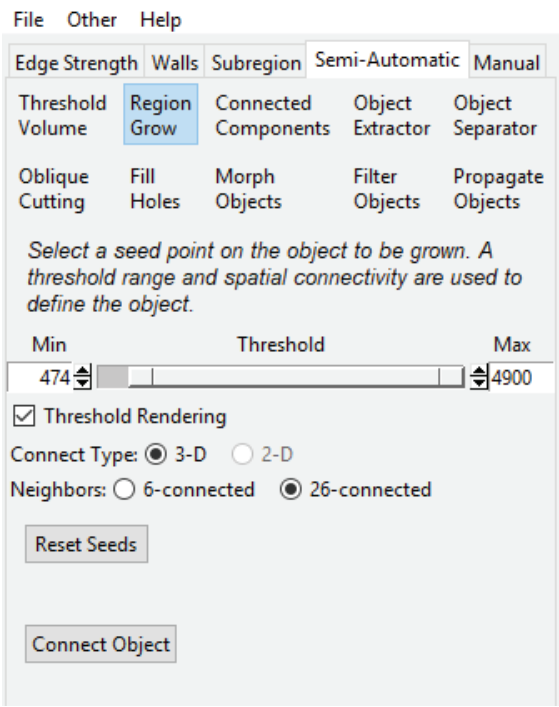
Whereas threshold-based segmentation applies globally to all voxels in the volume, region growing can be used to limit the segmentation to voxels that are connected to a user-defined seed point which fall within a specified threshold range.

To enable the Region Grow options, first a seed point must be set on the structure you wish to isolate [1]. Note, multiple seeds can be selected to facilitate the simultaneous segmentation of multiple objects as long as the objects have the same threshold properties, for example multiple disconnected bones.



# Region Grow Options

When the seed is set the following options become available:




**Threshold slider:** The Threshold double-ended slider bar allows users to specify a range of threshold values using the minimum and maximum ends of the threshold slider. For a full description of the threshold slider please refer to the Threshold Volume section.

**Min** and **Max:** The minimum and maximum input field allows users to manually enter the minimum or maximum threshold value. There are also arrow up and down buttons the right of the input fields to increase or decrease the currently value by 1.

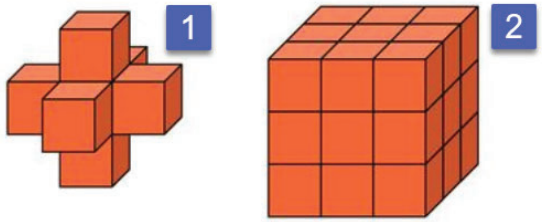
**Threshold Rendering:** Allows users to disable and enable to 3D preview of the selected voxel range. Disable this option by unchecking the checkbox when working with large data sets.

**Connect Type:** Determines if the connection type will be 3D or 2D.

**3-D:** Region grow will be applied to the (3D) volume.

**2-D:** Region grow will be limited to the current (2D) slice.

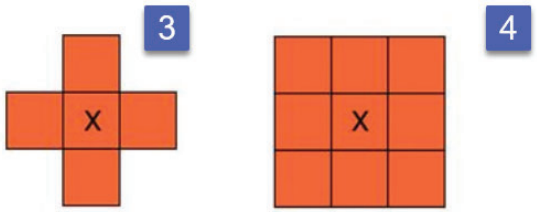
**Neighbors:** Allows users to select the number of neighboring voxels during the connection process. The options available depend on the connect type. For 3D, users can choose 6-connected or 26-connected. For 2D, 4-connected or 8-connected can be selected.




- **3D Neighbor options:**
  *6-connected:* Specifies that only 3-D neighbors are checked for connectivity during the region growing process. [1]
  *26-connected:* Specifies that the entire 26-voxel neighborhood is checked for connectivity during the region growing process. [2]

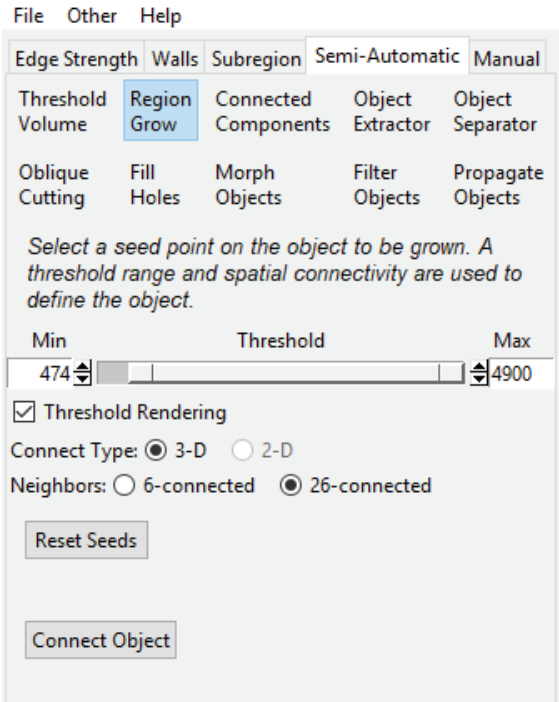
# Region Grow Options (continued)

- **2D Neighbor options:**
  *4-connected:* Specifies that only 2-D neighbors are checked for connectivity during the region growing process. [3]
  *8-connected:* Specifies that the entire 8-voxel neighborhood is checked for connectivity during the region growing process. [4]




**Reset Seeds:** Resets the user defined seed(s). Seeds can also be deleted by right clicking on the seed and then selecting delete.

**Connect Object:** Initiates the connection process.




**Threshold Slider right click options:** Right clicking on the Threshold slider provides users with access to the following additional options; Presets, Auto Threshold, Show/Hide Histogram. For more information please refer to the Threshold Slider right click options in the Threshold Volume section.

**Seed point right click options:** Right clicking on a seed point provides the following options:

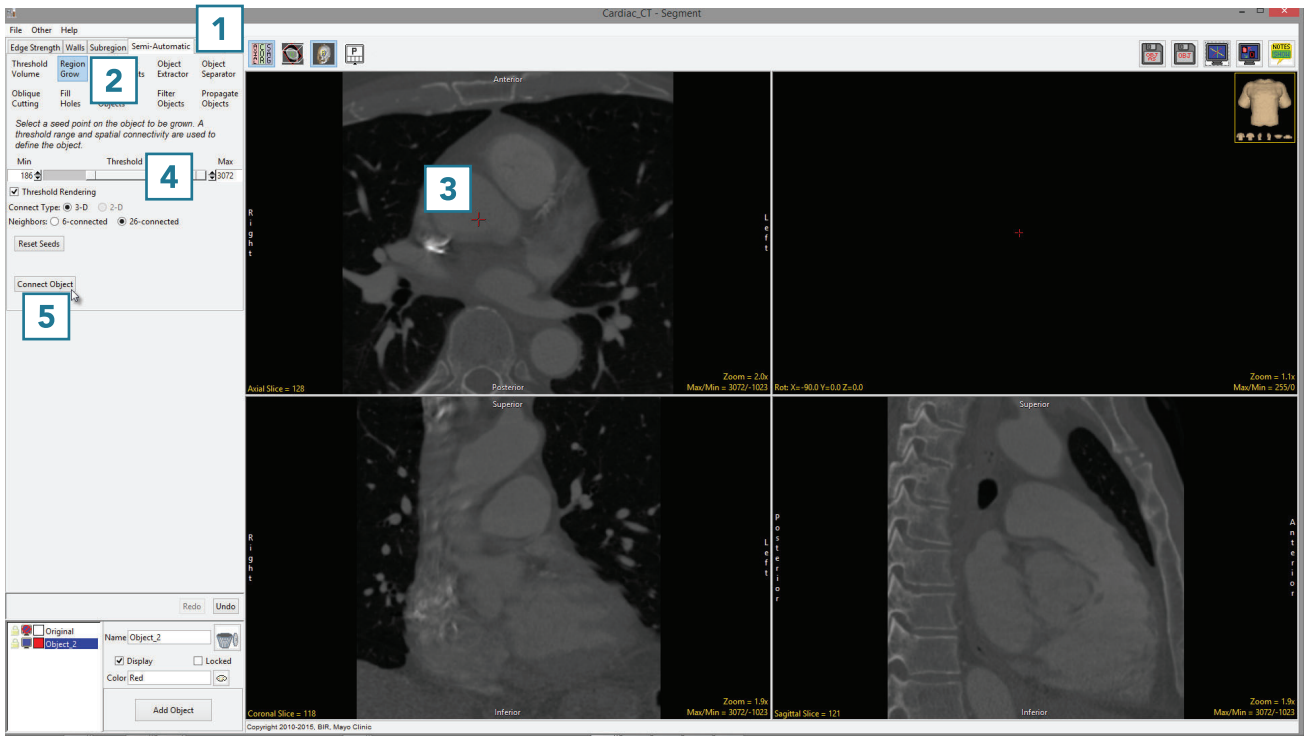
- **Style:** The style options allows users to change the of the seed point. Select from Dot, Crosshair (default), Arrow, and Diamond.
- **Label:** The label options allows user to enable and disable labels for seed points. Select from None (default), Number (useful when setting multiple seeds), and Tag.
- **Shadow:** Allows users to enable (default) or disable the shadow effect for the seed.
- **Delete:** Deletes selected seed point.

# 3D Segmentation with Region Grow

Here we will use Region Grow to segment a new object in a dataset.

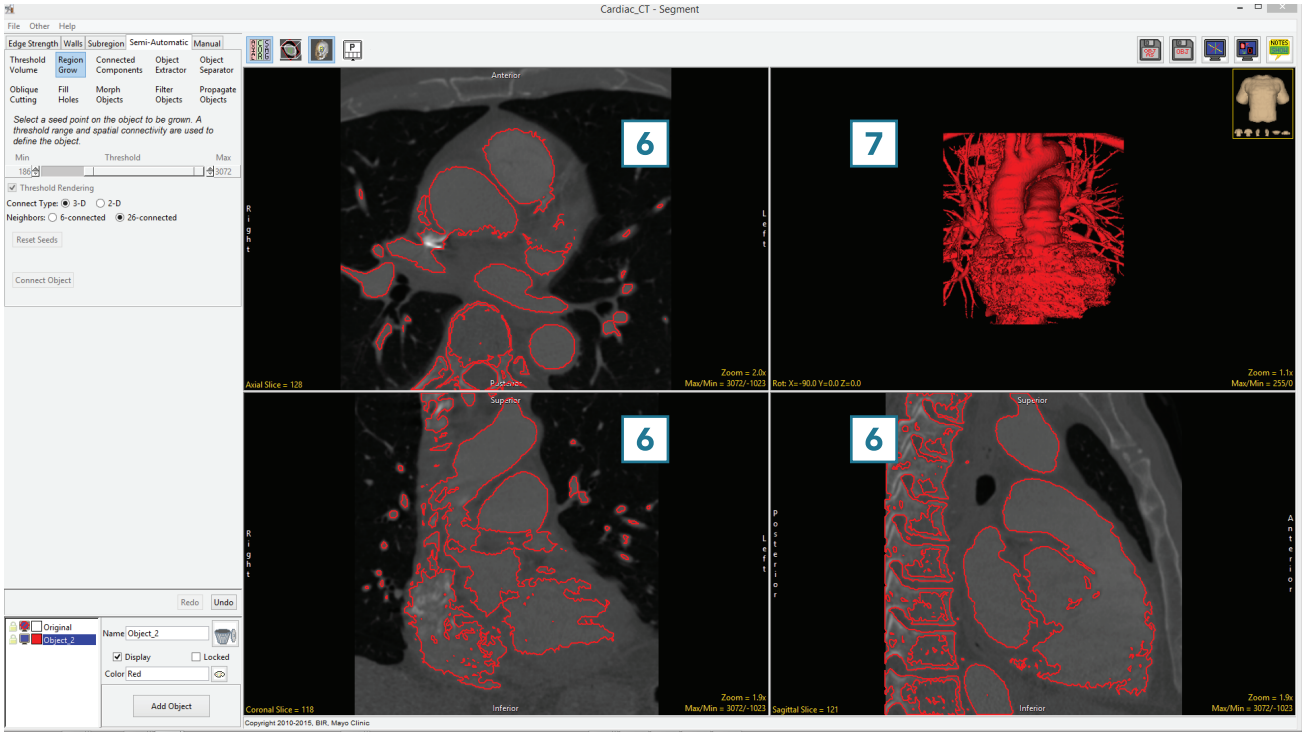
To follow along, download the data set CT_Heart from analyzedirect.com/data and load into Analyze using Input/Output.

- Select the data set and open Segment.
- Select Semi-Automatic [1] and choose Region Grow [2].
- Click on the image data to set a seed point in the object you would like to isolate [3]
- Set the Threshold Min/Max values to define the object [4]
- Click Connect Object [5].



# 3D Segmentation with Region Grow (continued)

- The voxels fulfilling the seed point and threshold criteria for the region grow will be assigned to a new object.
- The segmented object is shown overlaid on the 2D slice data [6] and a 3D rendering [7] is displayed.

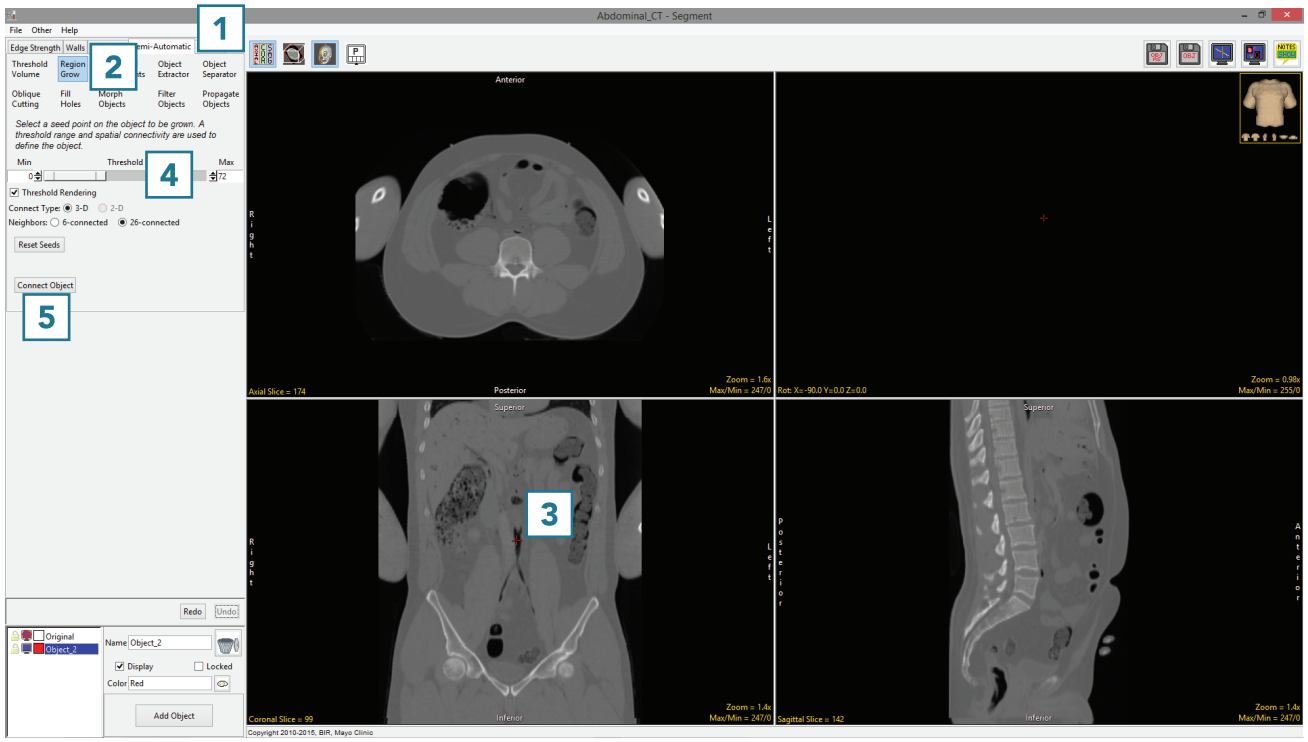


# 3D Segmentation with Region Grow (continued)

It may be necessary to adjust the number of neighbors used in order to limit the region grow. This will help prevent unwanted objects from being segmented with the target object.

To follow along, download the data set VH_Abdomen from analyzedirect.com/data and load into Analyze using Input/Output.

- Select the data set and open Segment.
- Select Semi-Automatic [1] and choose Region Grow [2].
- Click on the image data to set a seed point in the structure you would like to isolate [3].
- Set the Threshold Min/Max values to define the object [4] and click Connect Object [5].

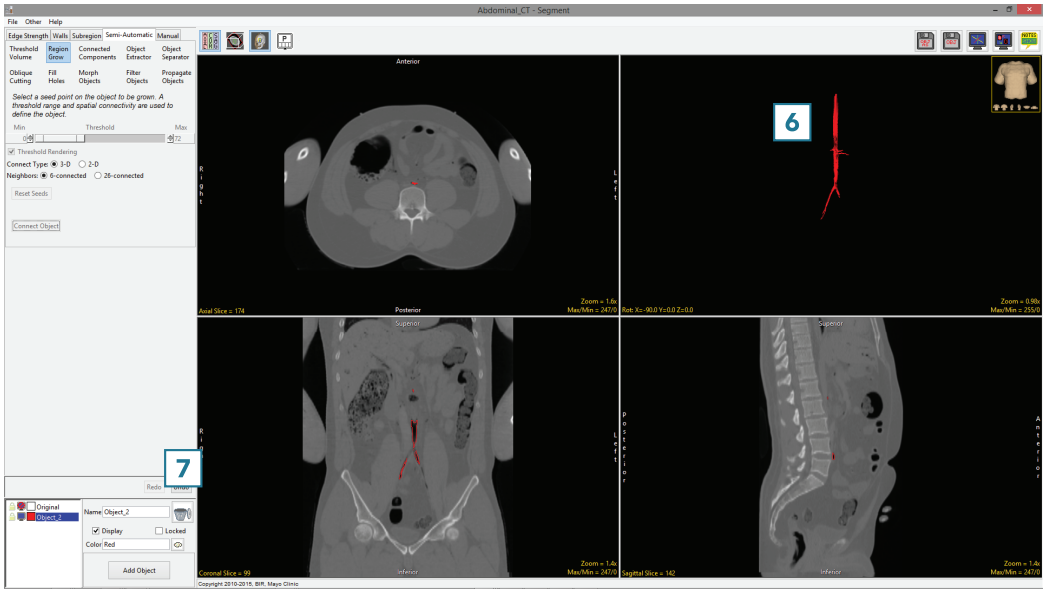


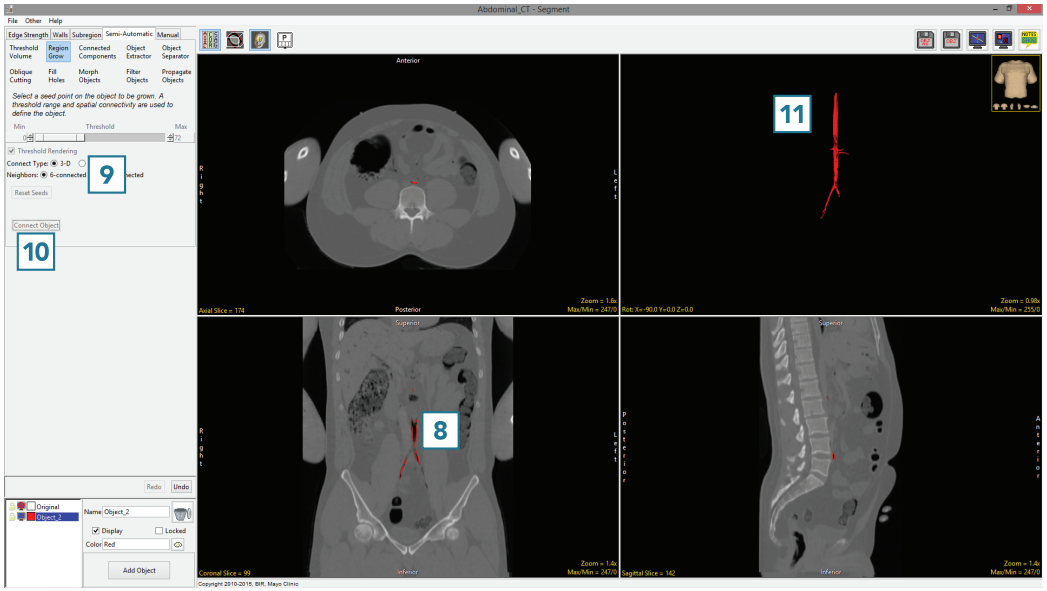
# 3D Segmentation with Region Grow (continued)

Note that the segmentation of the abdominal aorta in the example, using the default 26-connected neighbors, also assigns part of the left lung into the object [6].

- Click Undo [7]
- Set the seed point, [8] set Neighbors to 6-connected, [9] and click Connect Object [10].

Note the segmentation result for the abdominal aorta [11] no longer contains part of the left lung.



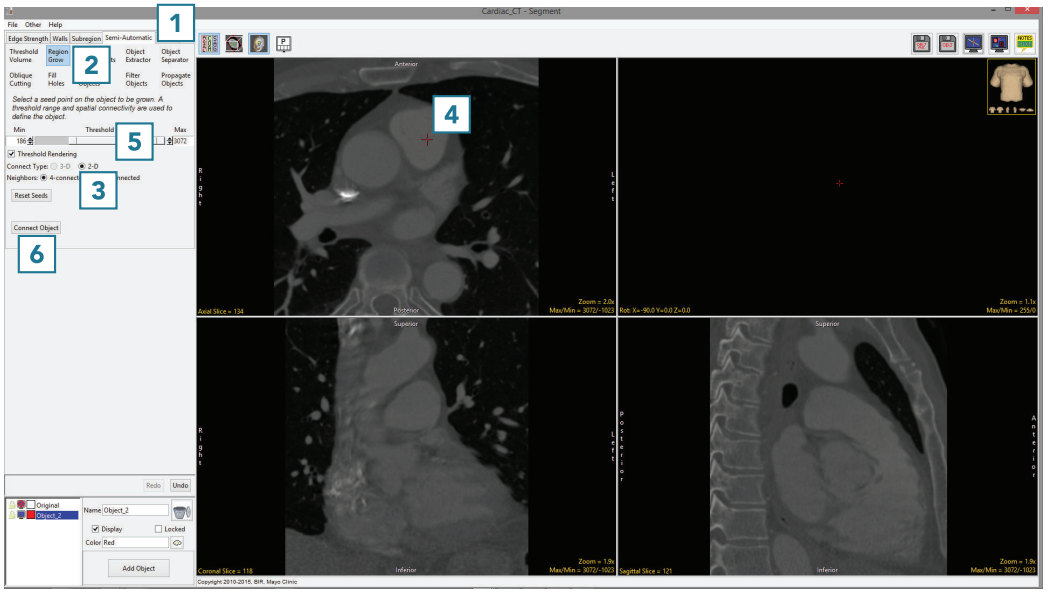



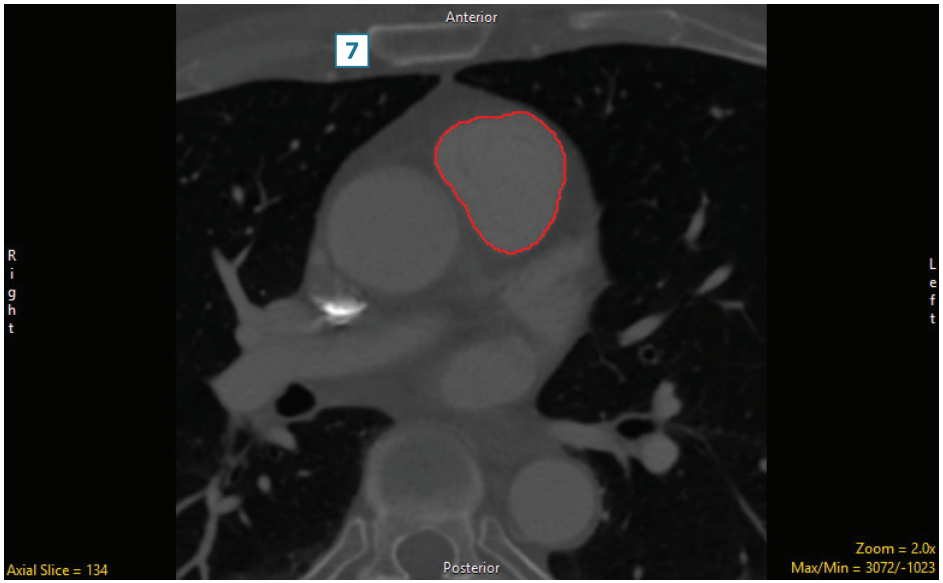
# 2D Segmentation with Region Grow

Region grow also provides the ability to limit the region to a single slice via the 2D Connect Type option.

To follow along, download the data set CT_Heart from analyzedirect.com/data and load into Analyze using Input/Output.

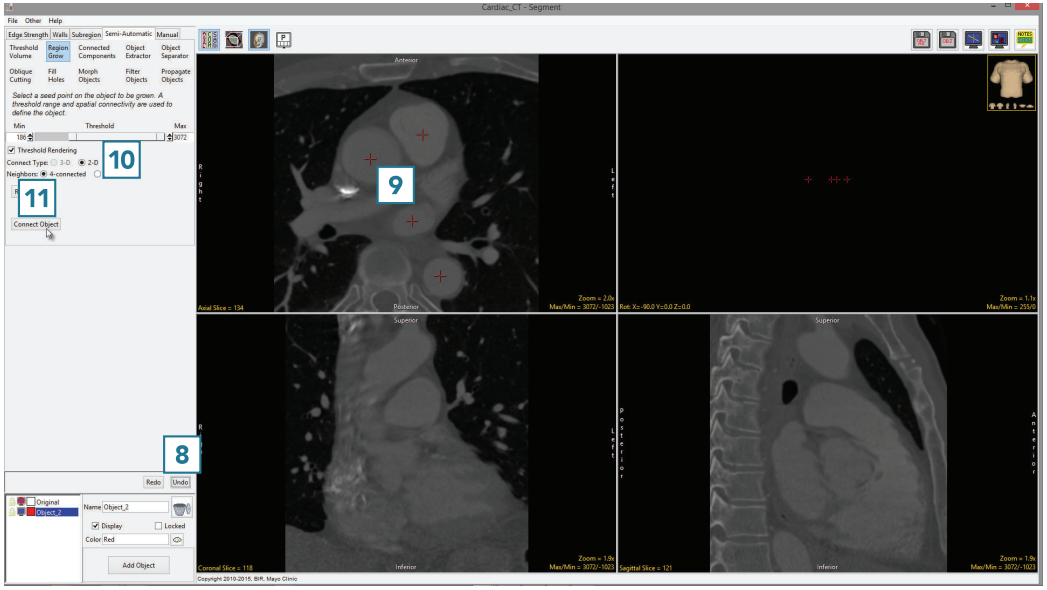
- Select a data set and open Segment.
- Select Semi-Automatic, [1] choose Region Grow [2 and set the Connect Type to 2D. [3].
- Click on the image data to set a seed point. [4] The seed point should be in the 2D structure you would like to isolate.
- Set the Threshold Min/Max values to define the object [5] and click Connect Object. [6].
- The region will be isolated on the single slice [7].



# 2D Segmentation with Region Grow (continued)

- To segment multiple 2D regions, click Undo [8].
- Click on the image data to set multiple seed points on the regions you want to segment [9].
- Set the Threshold Min/Max values to define the object [10] and click Connect Object [11].




- All of the regions falling within the threshold criteria will be isolated in 2D [12].