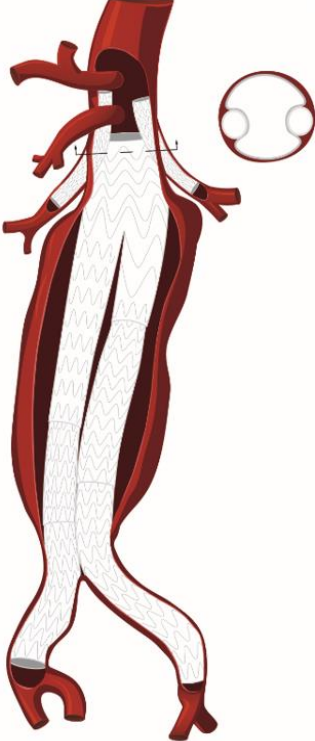
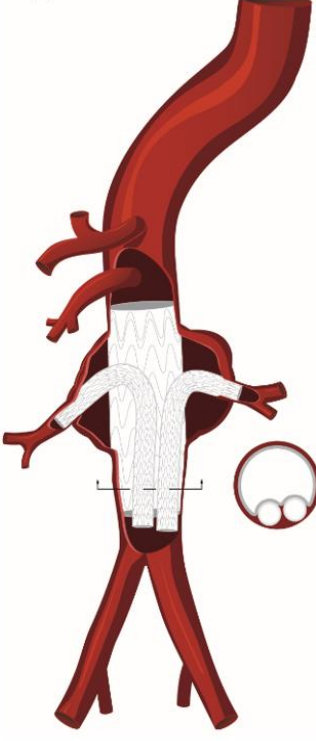
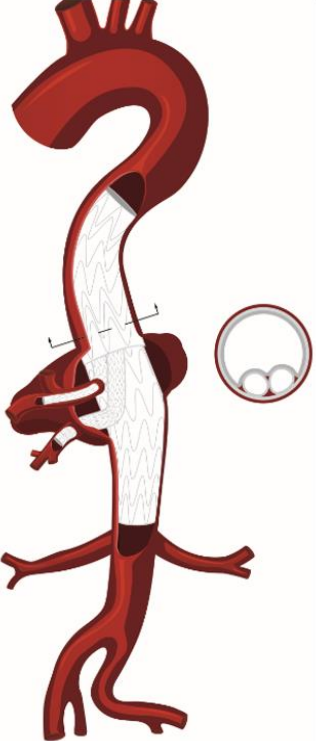
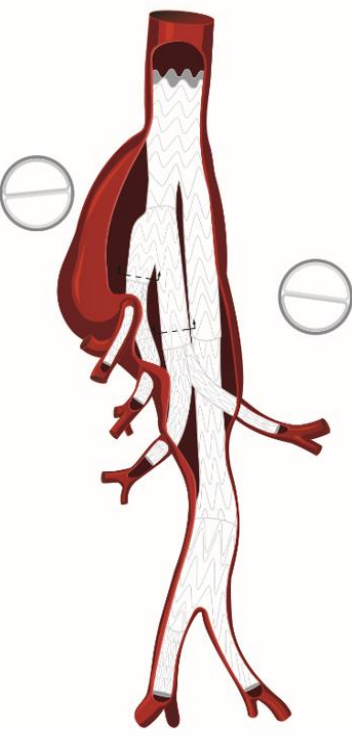


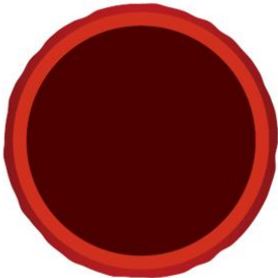
Common physician-chosen parallel graft techniques

Chimney / Snorkel	Periscope	Sandwich	Octopus
 <p>The diagram shows a bifurcated aortic graft with two parallel stents. One stent is positioned higher than the other, allowing the lower stent to be placed within the lumen of the upper stent. A circular inset shows a cross-section of the aorta with two side-by-side stents.</p>	 <p>The diagram shows a bifurcated aortic graft with two parallel stents. The stents are positioned side-by-side, with the lower stent placed within the lumen of the upper stent. A circular inset shows a cross-section of the aorta with two side-by-side stents.</p>	 <p>The diagram shows a bifurcated aortic graft with two parallel stents. The stents are positioned side-by-side, with the lower stent placed within the lumen of the upper stent. A circular inset shows a cross-section of the aorta with two side-by-side stents.</p>	 <p>The diagram shows a bifurcated aortic graft with multiple branches. The branches are anchored into the limbs of the bifurcated aortic main body. A circular inset shows a cross-section of the aorta with multiple branches.</p>
<ul style="list-style-type: none">• Chimney and Snorkel terms often used interchangeably• Parallel stents for downward-orienting (antegrade-filling) vessels• Upper Extremity (e.g. brachial) access typically required	<ul style="list-style-type: none">• Parallel stents for upward-orienting (retrograde-filling) vessels• Femoral access typically required	<ul style="list-style-type: none">• Parallel stents implanted between (i.e., 'sandwiched' between) the aortic main body	<ul style="list-style-type: none">• Multiple branches anchored into the limbs of the bifurcated aortic main body

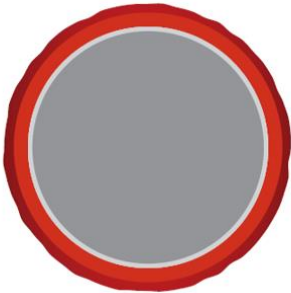
comparison of self-expanding stents (SX) and balloon-expandable stents (BX) in parallel stenting applications	
SX	BX
<ul style="list-style-type: none">• Stent frames are comprised of nitinol• Nitinol shape memory allows for expansion to nominal diameter without support of a balloon <p>Typically:</p> <ul style="list-style-type: none">• Weaker radial force / easily compressed• Longer lengths – potential to avoid additional stent grafts to extend length• Lower delivery profiles• High flexibility / conformability• Potential for ‘bow-stringing effect’ (GORE® VIABAHN® Endoprosthesis)	<ul style="list-style-type: none">• Generally comprised of stainless steel or cobalt chromium• Mounted on balloon delivery systems to enable deployment <p>Typically:</p> <ul style="list-style-type: none">• Higher radial force and good fluoroscopic visibility• Shorter lengths – may require additional stent grafts to extend length• Precise placement in the target vessel• Ability to be more tailored to the anatomy, post-dilation (ability to post-dilate the device to taper it to the vessel)*

What are “gutters” or “gutterleaks”?


“Gutters” are the spaces between parallel-implemented devices, where the inner-most device does not conform sufficiently around the outer device(s). These gaps could potentially lead to endoleaks, or “gutterleaks” as blood continues to flow through them.




Axial view of aorta



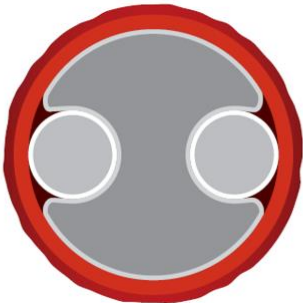
Correctly sized aortic stent graft: apposes vessel wall



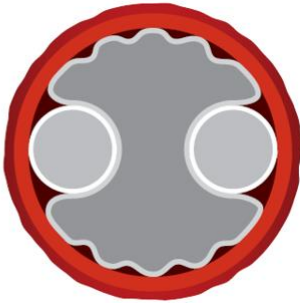
Oversized aortic stent graft leads to device infolding which may lead to a Type I Endoleak



Appropriately-sized aortic stent graft conforming around two implanted parallel stents^{11, 18}



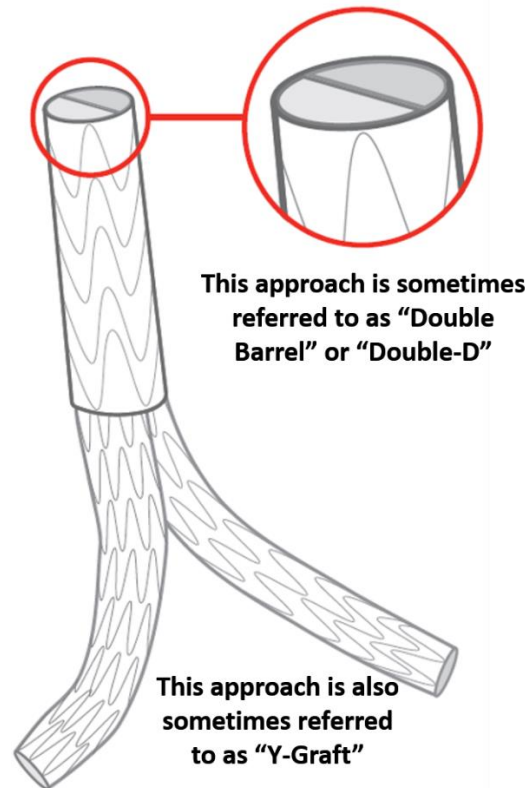
Undersized aortic stent graft – does not conform to parallel stents; the spaces between the grafts (aka ‘gutters’) may contribute to endoleak



Oversized aortic stent graft leads to infolding; device does not conform to vessel wall or parallel stents, resulting in ‘gutters’ or Type I Endoleaks^{10,17}

Physicians' best practice considerations when calculating *multiple devices inside one larger device* (the 'Double Barrel')

Physicians may decide to branch into more than one vessel by implanting multiple devices from inside one larger device. This approach is sometimes known as "Double Barrel" or "Y – Graft"¹⁹.

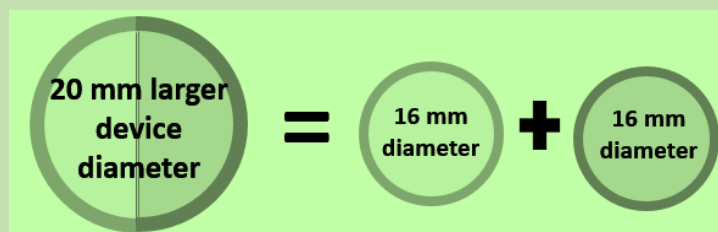


Same Size Parallel Stents for 'Double Barrel'

Literature suggests that parallel stent sizing **NOT** be based on dividing larger graft diameter by 2, as doing so would lead to infolding²⁰.



Instead, one study suggests the parallel stents be at 80% of the larger device diameter²⁰.



Note that the approach described above is just one example of how physicians might determine device sizing. The physicians you work with may have their own approach that is different.