Microvascular rarefaction, defined by a loss of arterioles and/or capillaries, is a common characteristic of hypertension. Recent work in our laboratory suggests that microvascular rarefaction in adult spontaneously hypertensive rats is more complex and is also associated with network patterning alterations. The objective of this study was to investigate the influence of microvascular architectures on network resistance in young hypertensive versus normotensive rats. Mesenteric tissues from age-matched (7-8 weeks) male spontaneously hypertensive (SHR; n=13), Wistar-Kyoto (WKY; n=7) and Wistar (n=8) rats were harvested and immunolabeled with PECAM, an endothelial cell marker. SHR microvascular networks displayed reduced branching, increased arteriole/venous shunts and increased arteriole/venous anatomoses. A computational model was used to calculate resistances based on vessel lengths, diameters and an assumed pressure drop of 65 mmHg. WKY (34.9 ± 7.4 mmHg/mL) networks had significantly increased resistance compared to SHR (19.7 ± 5.3 mmHg/mL) and Wistar (15.7 ± 5.7 mmHg/mL) networks. These observations suggest that altered microvascular network patterns associated with hypertension do not necessarily lead to elevated resistance.