AbstractID: 11179 Title: Morphological characterization of arterial trees in an experimental hindlimb ischemia model.

Purpose:

The objective of this study was the morphological analysis of the arterial trees depicted in digital subtraction angiographic (DSA) images from a well known mammalian experimental hindlimb ischemia model. Our purpose was to provide insight into the discriminative characteristics of arterial trees in normal, acute and chronic ischemic limbs.

Method and Materials:

We present three characterization methods for extracting information from arterial trees in order to capture tree features; topological patterns, asymmetry and branch density. The first method proposes the Prüfer encoding of the trees followed by the tf-idf technique and the cosine similarity metric to compare the topological patterns of trees. The second uses the tree asymmetry index to quantify the asymmetry of tree topologies and the final one is based on Sholls' analysis to compute the tree branch density. These methods were applied on a series of DSA images of segmented collateral vessels in the aforementioned model (three subjects).

Results:

Ischemia was induced in day number 0 on one limb of each animal while the contralateral was left intact. Revascularization, through normal angiogenesis, is known to have been accomplished after 40 days. The topological patterns were evaluated in three groups; the chronic ischemic (group A), the normal (group B) and the acute ischemic (group C) arterial trees. Our results demonstrate that the arterial structures from group A have similar topological patterns to group B, compared to group C (mean similarity percentage=78% and 66% respectively). Moreover, the arterial trees from group A appear more asymmetric and with increased density of branches compared to the acute ischemic arterial trees (group C).

Conclusion:

In this study we presented three techniques for characterizing and analyzing the arterial tree-like structures in a series of DSA images, thus illustrating the potential of the proposed tree characterization framework.