While there have been many studies on using deep learning for medical image analysis, the lack of manually annotated data remains a challenge in training a deep learning model for segmentation of medical images. This work shows how the kaleidoscope transform (KT) can be applied to a 3D convolutional neural network to improve its generalizability when the training set is extremely small. In this study, the KT was applied to a context aggregation network (CAN) for semantic segmentation of anatomical structures in knee MR images. In the proposed model, KAN3D, the input image is rearranged into a batch of downsampled images (KT) before the convolution operations, and then the voxels are rearranged back to their original positions (inverse KT) after the convolution operations to produce the predicted segmentation mask for the input image. Compared to the CAN3D (without the KT), the KAN3D was able to reduce overfitting without data augmentation while maintaining a fast training and inference time. The paper discusses the observed advantages and disadvantages of KAN3D.