Coherent Optical Tomography Imaging of Epidermal Hyperplasia in Vivo in a Mouse Model of Oxazolone Induced Atopic Dermatitis

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Abstract : Laboratory animals are currently widely used as a model of human pathologies in dermatology such as atopic dermatitis (AD). These models provide a better understanding of the pathophysiology of this complex and multifactorial disease, the discovery of potential new therapeutic targets and the testing of the efficacy of new therapeutics. However, confirmation of the correct development of AD is mainly based on histology from skin biopsies requiring invasive surgery or euthanasia of the animals, plus slicing and staining protocols. However, there are currently accessible imaging technologies such as Optical Coherence Tomography (OCT), which allows non-invasive visualization of the main histological structures of the skin (like stratum corneum, epidermis, and dermis) and assessment of the dynamics of the pathology or efficacy of new treatments. Briefly, female immunocompetent hairless mice (SKH1 strain) were sensitized and challenged topically on back and ears for about 4 weeks. Back skin and ears thickness were measured using calliper at 3 occasions per week in complement to a macroscopic evaluation of atopic dermatitis lesions on back: erythema, scaling and excoriations scoring. In addition, OCT was performed on the back and ears of animals. OCT allows a virtual in-depth section (tomography) of the imaged organ to be made using a laser, a camera and image processing software allowing fast, non-contact and non-denaturing acquisitions of the explored tissues. To perform the imaging sessions, the animals were anesthetized with isoflurane, placed on a support under the OCT for a total examination time of 5 to 10 minutes. The results show a good correlation of the OCT technique with classical HES histology for skin lesions structures such as hyperkeratosis, epidermal hyperplasia, and dermis thickness. This OCT imaging technique can, therefore, be used in live animals at different times for longitudinal evaluation by repeated measurements of lesions in the same animals, in addition to the classical histological evaluation. Furthermore, this original imaging technique speeds up research protocols, reduces the number of animals and refines the use of the laboratory animal.

Keywords : atopic dermatitis, mouse model, oxzolone model, histology, imaging
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