Noninvasive diagnostic approaches for psoriasis and lupus erythematosus

Anna Berekmeri[1,2]*, Mohammad Shalbaf[1]*, Adewonuola Alase[1], Yuzaiful MD Yusof[1,2], Tom Macleod[3], Mark Goodfield[4], Philip Laws[4], Philip Helliwell[5], Natalia V. Botchkareva[6], Edward M. Vital[1,2], Martin Stacey[3], Miriam Wittmann[1,2]

[1] Leeds Institute of Rheumatic and Musculoskeletal Medicine (LIRMM), University of Leeds, UK;
[2] NIHR Leeds Biomedical Research Centre (BRC), Leeds Teaching Hospitals, Leeds, UK;
[3] Faculty of Biological Sciences, School of Molecular and Cellular Biology, University of Leeds, UK;
[4] Department of Dermatology, Leeds Teaching Hospitals, Leeds, UK;
[5] Bradford Teaching Hospitals Foundation Trust, Bradford, UK;
[6] Centre for Skin Sciences, University of Bradford, UK.
*equal contribution

Background Diagnosis based on morphology alone can be challenging in cases of minimal disease activity or in certain anatomical localisations. The diagnosis and treatment of psoriatic arthritis is often delayed by the underrecognition of psoriasis. Similarly, the nature and activity of scarring alopecias is often difficult to assess as symptoms of permanent damage and signs of activity can overlap or be difficult to distinguish. The standard diagnostic pathway involves a biopsy, however, this is an invasive and expensive procedure. There is a yet unmet need for an easy to perform, non-invasive diagnostic which allows early and accurate diagnosis of both psoriasis and CDLE, and classification of ambiguous/undetermined cases.

Methods Here we report the diagnostic value of two noninvasive techniques, hair plucking and tape stripping. 5-10 hair follicles from the scalp of patients with CDLE, psoriasis as well as healthy volunteers were plucked, cryosectioned, followed by RNA isolation. Hair follicle gene expression was analysed by microarray and quantitative real time PCR. Tape stripping was performed (10 consecutive CuDerm discs) from lesional psoriatic and eczematous skin and from other erythrosquamosus diseases, such as lupus erythematosus, lichen planus and fungal infection as well as from non-lesional and healthy skin.

Results A number of diagnostic features of CDLE can be linked to differentially expressed mRNA in epidermal material from plucked hair and these include genes related to apoptotic cell death (*OAS2, OASL,* and *XAF1*), interferon signature (*MxA, IFI6, IFIH1, BST2*), complement activation (*C3*) and CD8+ T cell immune responses (*B2M*). The expression profiles of plucked hair follicles parallels published expression profiles of CDLE full biopsy lesions. Our tape stripping results show that IL-36γ, inflammatory cytokine from the IL1 family, is a reliable biomarker for the diagnosis of psoriasis. Its high expression in psoriatic lesional skin allowed differentiation in clinically challenging cases, where even skin biopsy failed to provide certain diagnosis.

Conclusions Our results suggest that information obtained from hair plucking are sufficient to diagnose scalp LE. However, this hypothesis has to be further validated in routine clinical settings. Quantification of IL-36γ levels in tape stripping samples is a highly specific diagnostic tool to identify psoriasis. As non-invasive diagnostic methods, both plucked hair analysis and tape stripping can complement or even replace more invasive techniques in the future and facilitate early diagnosis.