Prognostic Value of Ultrasound Biomicroscopy in Alopecia Areata

Thesis

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ABSTRACT

Background:

Alopecia areata (AA) is an autoimmune disorder of the hair follicle characterized by inflammatory cell infiltrates around anagen hair follicles. The ultrasound biomicroscopy (UBM) technique generates high resolution echographic images using acoustic frequencies between 20 and 200 MHz which enables non-invasive visualization of cutaneous structures.

Objective:

To detect the accuracy of ultrasound biomicroscopy (UBM) in evaluating cases of alopecia areata and detecting the changes in hair follicles through correlating its findings with clinical and pathological assessment.

Methods:

Thirty patients with AA above the age of 18 years underwent history taking & full clinical examination. UBM examination of an area of AA in the scalp was done in all patients followed by punch biopsy (4 mm) for histopathological examination. In cases of patchy alopecia the same was done in a normal area of scalp as a control.

Results:

No significant difference was found between UBM imaging and histopathological assessment as regards number of hair follicles in areas affected by AA (P:0.655) as well as in control areas (P:0.102) with a significant positive correlation (P:<0.001, r:0.870) denoting that the UBM findings reflect sensitively the histopathological changes in the scalp in the area imaged. This was also the case on analyzing data of cases with patchy AA and those with AT and AU

separately. A negative correlation was found between the number of follicles in UBM imaging of areas of AA and duration of illness (P: 0.05, r:-0.358) meaning that the longer the disease duration the fewer the number of hair follicles.

Similarly there was no significant difference between UBM imaging and histopathological assessment as regards the width of the hair follicles (P: 0.102). A negative correlation was also found between the width of the follicles in UBM imaging of AA areas and the duration of illness (P:0,021,r:-0.428) which could be explained by the fact that two events that occur in long-standing cases which are slightly reduced inflammatory infiltration and miniaturization of hair follicles.

Conclusion:

In alopecia areata good or even excellent correlation between ultrasonic and histological measurements of hair follicle number and width was evident in this study; UBM examination could have clinical applications on prognosis and follow-up of cases of AA during therapy.

Key words: Alopecia areata, Ultrasound biomicroscopy.

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List of abbreviations

AA	*Alopecia Areata*
µm	*Micro-meter*
ACTH	*Adrenocorticotrophic Hormone*
AT	*Alopecia totalis*
AU	*Alopecia universalis*
BAFF	*B- cell Activating Factor*
CD 4	*Cluster of differentiation 4*
CT	*Computerized Tomography*
CTL	*Cutaneous T lymphocytes*
dcSSc	*Diffuse cutaneous SSc*
DNA	*Double stranded nucleic acid*
DPCP	*Diphenylcyclopropenone*
ECM	*Extracellular Matrix*
GHz	*Gega Hertz*
HFUS	*High Frequency Ultrasound*
ICAM	*Intercellular Adhesion Molecules*
IFN- γ	*Interferon Gamma*
IGF-1	*Insulin Like Growth Factor 1*
ILs	*Interlukins*
IP-10	*Interferon Inducible Protein 10*
lcSSc	*Limited cutaneous SSc*

List of abbreviations

MHC	*Major histocompatibility complex*
MHz	*Mega Hertz*
MIF	*Macrophage Migration Inhibitory Factor*
MIG	*Monokine Induced by IFN- γ*
mm	*Milli-meter*
mRNA	*Messenger Ribonucleic Acid*
PBMCs	*Peripheral Blood Mononuclear Cells*
PUVA	*Psoralin Plus UVA*
RCM	*Reflectance confocal microscopy*
SLEB	*Subepidermal Low Echogenic Band*
SSc	*Systemic Sclorosis*
TGF-β	*Transforming Growth Factor beta*
Th1	*T-helper 1*
TNF-α	*Tumor necrosis factor alpha*
UBM	*Ultrasound Biomicroscopy*
US	*Ultrasound*
UVA	*Ultraviolet A*

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Introduction and Aim of Work

Ultrasound scanning is becoming an important diagnostic tool in dermatology. The major advantages of this technique are its non-invasive, non-ionizing nature and its relatively low cost ***(El-Zawahry et al., 2007).*** It is easy to use, completely safe, and provides important diagnostic information ***(Schmid-Wendtner and Burgdorf, 2005)***. Technological advances have enabled the application of high resolution ultrasonic imaging of the skin ***(Rallan and Harland, 2003).***

The ultrasound biomicroscopy (UBM) technique generates high resolution echographic images using acoustic frequencies between 20 and 200 MHz. In dermatology, it enables non-invasive visualization of cutaneous structures ***(Petrella et al., 2010)***.

Alopecia areata (AA) is an autoimmune disorder of the hair follicle characterized by inflammatory cell infiltrates (predominantly of activated T lymphocytes along with macrophages and Langerhans cells) around actively growing (anagen) hair follicles ***(Siebenhaar et al., 2007)***.

Interestingly, the extent of lymphocytic infiltration of the follicle may correlate with responsiveness to therapy – as increased lymphocytic infiltration has been associated with a poor response to treatment with contact immunotherapy (diphencyprone) ***(Freyschmidt-Paul et al., 1999)***. In chronic eczema reduced echogenicity of the upper dermis was observed due to infiltration with inflammatory cells ***(Jemec et al., 2000)***.

In addition affected hair follicles terminate the anagen phase prematurely and regress via the induction of massive apoptosis of the lower portion of the follicle (catagen phase), resulting in a resting hair follicle (telogen phase). Hair follicles may then re-enter the anagen phase, but in the presence of lymphocytic infiltrate, anagen is terminated prematurely, resulting in miniaturized hair follicles ***(Whiting, 2003)***.

These changes (inflammatory infiltrate and miniaturization of hair follicles) may produce specific findings in USB examination of the scalp. A single skin biopsy taken from the scalp in alopecia areata may not be representative of other affected areas especially in cases of alopecia totalis. Taking multiple skin biopsies is both impractical and invasive therefore a scanning non-invasive technique will be of great significant prognostic value in cases of extensive alopecia areata.

Aim of work:

To evaluate the accuracy of ultrasound biomicroscopy (UBM) in the prognosis of alopecia areata and to detect the changes in hair follicles through correlating its findings with clinical and pathological assessment.

Alpecia Areata

Definition:

Alopecia areata (AA) is a nonscarring, autoimmune, inflammatory, hair loss on the scalp, and/or body ***(Wasserman et al., 2007).***

Epidemiology:

Alopecia areata (AA) is a common disease. Its prevalence is 0.1% and its lifetime risk is about 2%. The disorder affects children, men, and women of all hair colors. Most patients are younger, although the disorder is uncommon below the age of 3years. The highest prevalence is seen between the second and fourth decades of life. Up to 66% of patients are below 30 years old, while only 20% are older than 40 ***(Finner, 2011).***

Clinical picture:

Alopecia areata is unique in that its clinical manifestations in the form of hair loss and nail affection are neither constant nor cyclic or expressed in all relevant cells at one time but are rather expressed sporadically. Regrowth of hair may occur spontaneously months to years after the onset of the disease. However, the hair loss may persist indefinitely despite therapeutic interventions. The onset of AA in infancy, early childhood, the presence of atopy, and the total loss of scalp hair appear to be factors that independently encourage persistence and/or recurrent episodes of hair loss ***(Olsen, 2011).***

The first presentation of hair loss may begin at any age ***(Olsen, 2011).*** The disease can present as a single, well demarcated patch of hair loss or as multiple patches. It can also present in an extensive form with total loss of scalp hair