Synovial vascular perfusion parameters derived from quantitative analysis of CEUS correlates with pathogenic CD4$^+$ Th17 cells lineages in the psoriatic arthritis joint


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• 22% of US adult populations is diagnosed with some form of arthritis

• 10% of the US population suffers from limitations attributable to arthritis

• Psoriatic arthritis (PsA) is a systemic
  – immune-mediated disease,
  – enthesitis, synovitis and osteitis,
  – marked clinical heterogeneity

Early diagnosis

Early differential diagnosis

Treatment assessment
From synovitis to erosion

Disease progression

Synovitis
First stage

- Swollen capsule
- Reduced fluid
- Hyperplastic membrane
- Tendon inflammation

Pannus formation
Second stage

- Widespread inflammation
- Pannus formation
- Bones erosion
Angiogenesis signalling

Vascular heterogeneity: tumor

Normal microvasculature

Tumor microvasculature

Cancer Res; 73(18) September 15, 2013

Cancer Research; 71(22), November 2011
Angiogenesis signalling

T cell

Synovial flow: patterns heterogeneity
Molecular mechanisms of joint inflammation causes neoangiogenesis

Vessels and perfusion can be imaged by several modalities

Can we link different perfusion patterns to different molecular activations?
Enhanced Gamma model - SCR

Gamma model

Parametric mapping
How to summarize the maps?

- Standard deviation
- 25\textsuperscript{th} percentile
- 75\textsuperscript{th} percentile
- Mean

$t_0$
Linking parametric map to specific CD4+ expression

Gate on CD4+CD161+

IL17A-F

IL23R

?
• 8 patients with active psoriatic arthritis, fulfilling CASPAR criteria

• Preliminary B-mode and Power Doppler, followed by CEUS

• Synovial fluid and blood samples. Counting: CD4+, CD4+IL23+, CD4+IL17A-F+, CD4+IL17A-F+IL23+
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Correlations

Fiocco et al, Clinical Rheumatology, in press
Conclusions

• Th17 cells are known to be involved in the (pathological) angiogenetic processes

• Quantitative pixel-wise analysis of CEUS data allows the characterization of the perfusion patterns and their heterogeneity

• Perfusion parameters are strongly correlated with expression of specific CD4+ Th17 cells