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Role of Power Doppler Sonography in hemophilic synovitis

Synovitis occurs following recurrent episodes of acute, spontaneous hemorrhages into joints. Degenerative changes such as hypertrophy and inflammation of synovial tissues is followed by disruption of articular cartilage requiring expensive rehabilitation and/or total joint replacement. Treatment is aimed at preventing joint bleeds, using prophylactic factor replacement therapy, which is expensive, and the optimal regimen of which is unclear. Isotopic or surgical synovectomy may be required to control repeated joint bleeding in patients who fail prophylaxis or develop inhibitors, but the optimal timing of this is widely debated.

Conventionally, synovitis was diagnosed based on clinical examination and radiography, which together tend to underestimate the extent of joint damage. Currently, magnetic resonance imaging (MRI) is utilized for the evaluation of cartilage and synovium in hemophilic joint disease. However, the need for sedation in younger children, the limitations in differentiating active versus inactive synovitis and high costs preclude its utility, especially when more frequent monitoring may be needed for management decisions like prophylaxis and synovectomy. More recently, gray-scale sonography with Power Doppler Sonography (PDS) has been used in preliminary studies of joint diseases like rheumatoid arthritis for the assessment of synovium and surveillance after therapeutic interventions. PDS has been suggested as a method to detect and quantitate alterations in vascularity associated with the rheumatoid synovium, and to detect low velocity blood flow at the microvascular levels in diseases associated with angiogenesis.

Based upon these preliminary data, this project will test the hypothesis that PDS is sensitive and accurate in diagnosing hemophilic synovitis. Findings obtained on PDS will be compared to MRI as a reference standard. Studies will be conducted in hemophilic subjects with target joints (chronic joint disease) to establish whether PDS can be utilized to diagnose and quantitate hemophilic synovitis. Also, findings obtained on PDS will be quantitated (using vessel density and pixel scores) for assessment of response in pre- and post- synovectomy patients. PDS will subsequently be used in a pilot study to screen hemophilic children with two joint bleeds to detect early synovial changes.

If PDS is established as an accurate and sensitive imaging tool for detection of hemophilic synovitis, it could be used for more frequent surveillance to guide management decisions like prophylaxis and synovectomy in hemophilia. Imaging studies will also be correlated with serological markers of angiogenesis (vascular endothelial growth factor and its receptors) by ELISA and flow cytometry in all subjects undergoing PDS . Based upon preliminary data implicating angiogenesis in the pathophysiology of hemophilic joint disease in our laboratory, correlation of data obtained from PDS with serological markers of angiogenesis may aid in predicting joint disease activity and evaluating or even predicting bone destruction. Finally, inhibition of angiogenesis may prove useful as an adjunct to current factor replacement therapy.

> *“This project will test the hypothesis that Power Doppler Sonography is sensitive and accurate in diagnosing hemophilic synovitis”*

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