The Pathogenesis of Rotator Cuff Tendinopathy

George A C Murrell, MD, DPhil, Professor and Director

Orthopaedic Research Institute, St George Hospital, University of New South Wales, Sydney, Australia

We conducted on elite Australian swimmers. The swimmers were not complaining of pain, but when we examined their shoulders, they often had positive impingement signs and MRI visible tendinopathy of supraspinatus. The tendinopathy was related to the volume of swimming that they were doing. Those that swam more than 15 hours per week or more than 35 kilometres per week, were two to four times more likely to have supraspinatus tendinopathy. Louis Soslowsky and his group have shown similar findings in a running rat model and that tendinopathic tendon has increased cellularity, loss of collagen fibre organisation, larger tendons and inferior mechanical properties. Arnoczky, et al, showed that in a canine tendon stretch model, that tendon cells cyclically strained induce protein kinase, an important intracellular regulator and that protein kinase regulator was strain dependent. We found that the edges of torn supraspinatus tendons compared with uninjured subscapularis tendons had more than three-fold the amount of apoptosis (programmed cell death). Apoptosis often occurred around blood vessels and that the same apoptotic changes could be induced in a running rat model. Small new nerves are associated with these small blood vessels. Similarly, we found that tendinopathic tendon had increased heat shock proteins, increased caspases and cFLIP and hypoxia associated proteins. In a human cell culture model Millar et al, found that hypoxia drove cells to apoptosis and switched on Collagen III production. Hypoxia and IL17 switched collagen production to Collagen III through the MAP kinases and that MAP kinase inhibition reduced inflammation. IL-33 induced type III collagen synthesis was regulated by miRNA29a. So our current hypothesis is that overuse in high tension areas of supraspinatus leads to hypoxia, apoptosis, inflammatory cytokine production, type III collagen switching, tendon degeneration and eventually full-thickness tear.


