ophthalmologist to consider all possible muscle pathologies that might be playing a part, and specifically request MRI planes and gaze directions that would be informative in narrowing the differential diagnosis and in guiding treatment. Ophthalmologists cannot rely on radiologists or MRI technicians to understand the nuances of extraocular muscle anatomy and function well enough to direct the imaging strategy in complex situations such as these.

Just as new imaging modalities such as optical coherence tomography are revolutionising our understanding and management of retinal disease,[7] modern imaging modalities are revolutionising our understanding of extraocular muscle structure, function, and innervation. Ophthalmologists, and particularly strabismus and orbital surgeons, should review the new findings from orbital magnetic resonance imaging and correlate an immunohistochemistry, since even the fundamental anatomy of the orbit has changed considerably from what most have learned as residents,[8] challenging concepts such as ''oblique muscle dysfunction.''[9 10] We owe it to our patients to appreciate the progress in clinical anatomy, and to apply relevant and appropriate imaging techniques in our presurgical evaluations.

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Pterygium

Pterygium

A S Solomon

Can we provide medical and not surgical cure?

Pterygium is a common frequently occurring ocular surface lesion characterised by inflammation, angiogenesis, and cellular proliferation, which result in tissue remodelling.

In this issue of *BJO* (p 769), Wong and colleagues present the finding of a new gene that was changed in primary pterygium.

It is the gene for insulin-like growth factor binding protein-3, (IGFBP3), which modulates the effects of insulin-like growth factor on cells. IGFB3 was significantly decreased in pterygium samples compared with normal conjunctiva. Decreased levels of IGFB3 protein have been strongly correlated with the presence of cancer.[1] It might be that the low level of IGFP3 is related to loss of control of the cell proliferation process, which explains the continued growth of pterygium. Solomon and colleagues[2] found in their work an insulin-like growth factor binding protein-2 (IGFBP2) overexpression in pterygium body fibroblasts. This is strong evidence to support the transformed phenotype of these cells and may explain the continual process of growth of fibrovascular tissue. The above findings elucidate two of many factors that are implied in the appearance and the development of pterygium.

> An overall view of the growth process of pterygium reveals a multiplicity of factors that are correlated and interrelated

We have to remember that the increased incidence of pterygium is in people and populations that are exposed to excessive solar radiation. It is the ultraviolet light (UV) that plays the critical part in the pathogenesis of this disease. UV radiation starts a chain of events at the intracellular and extracellular level that involve DNA, RNA, and extracellular matrix composition. Di Girolamo and colleagues[3] showed in their work that UVB radiation stimulated the induction of matrix matalloproteinase (MMP)-1 expression in human ocular surface epithelial cells, which is mediated through the ERK1/2 MAPK dependent pathway.

Nolan and colleagues[4] found that UVB radiation creates overexpression of heparin binding epidermal growth factor (HB-EGF) in pterygial tissue. HB-EGF is a potent mitogen and may be considered a major driving force in the development of pterygium. Di Giorolamo and colleagues[5] correlated the two above findings in another study. They found that epidermal growth factor receptor signalling is partially responsible for the increased MMP-1 expression in ocular cells after UVB radiation. Tsai and colleagues[6] present a very important aspect of the pathology of pterygium—oxidative DNA damage. UV radiation is noxious to the conjunctiva tissue either by direct phototoxic effect or indirectly by formation of radical oxygen species (ROS). One of the markers of oxidative stress is 8-hydroxydeoxyguanosine (8-OHdG). It is the result of UV damage to DNA. An overexpression of 8-OhdG in pterygia was found in this study, a fact that correlates the UV with the oxidative damage to the conjunctiva and the creation of pterygium. The same evidence was found by Kau and colleagues.[7]

Pterygium involves in its development a vascular proliferative process. Marcovici and colleagues[8] found that VEGF and von-Willebrand factor (vWF) are overexpressed in pterygium tissue. This is evidence of the angiogenesis that is found during the development of pterygium.

An interesting finding can be related to the angiogenesis process. Ozdemir and colleagues[9] found that nitric oxide levels (NO) are lower in pterygium tissue than in normal conjunctiva. This fact might be the result of hyperirrigation of blood by the rich vascular net of the pterygium. This is opposite to the ischaemic conditions through which NO levels rise.

Naib-Majani and colleagues, in an immunohistochemical study,[10] presented results on the distribution of the extracellular matrix in pterygium. It was found that collagens III and IV were expressed, while collagens I, II, and VII were missing. Heparan sulfate was strongly expressed in blood vessel walls and epithelial membranes. The study indicates an active involvement of MMPs 8, 9, and 13 in the pathogenesis of pterygium.

An overall view of the growth process of pterygium reveals a multiplicity of factors that are correlated and interrelated. Di Girolamo and colleagues[11] show, in an overview of the pathogenesis of pterygium, that the cytokines, growth factors, and MMPs are the main groups involved in that process. Climatic and geographical location are factors inducing the appearance of pterygium.[12 13]

We can observe three main factors that lead to the final product, the pterygium—mitogenity, construction of a new vascular net, and remodelling of the extracellular matrix. Altogether they create a new vascular and fibrotic tissue, which has an aggressive way of growing to and over the cornea. Today, surgical removal is the common way to treat pterygium, but the recurrence rate is reported to be high.[14]

It might be that understanding the biochemical process, which takes place in the growth of pterygium, can lead to the development of topical medications that may prevent or stop the pterygium in its early stage.

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Cyclophotocoagulation

Endoscopic and transscleral cyclophotocoagulation

P A Bloom, S Dharmaraj

Current status

Diode laser transscleral cyclophotocoagulation (TSCP, or cyclodiode as it is commonly known in the United Kingdom), has become a popular minimally invasive treatment for glaucoma. Initially this modality was used only in eyes with advanced end stage glaucoma and with little or no visual potential, where most other surgical treatments had been tried and failed. This was because of traditional mistrust of earlier cycloablation methods, such as cyclocryotherapy, that were associated with a higher incidence of serious complications than TSCP. As confidence and experience of TSCP grows it is now being safely applied increasingly earlier in the glaucoma treatment paradigm and in eyes with greater visual potential[1]; it has even been suggested that TSCP be used as a one off primary treatment for glaucoma in developing nations with poor access to reliable medical and surgical follow up.

There is still, however, considerable local and regional variation in the use of this treatment (anecdotal impressions suggest that it is used more commonly and earlier for glaucoma treatment in the United Kingdom than in the United States), perhaps in part because of the relative paucity of high quality laboratory and clinical studies demonstrating if, why, and how it is effective. There is even less evidence concerning endoscopic cyclophotocoagulation (ECP), the more refined but less widely available cousin of TSCP.

In the April issue of the *BJO*, Lin *et al* published an important laboratory based study that adds to our understanding of the clinical effects and complications of cyclophotocoagulation (CP).[2] They have attempted to quantify the evolution of vascular changes following CP; their results demonstrate that both TSCP and ECP are associated with an acute occlusive vasculopathy, but that with the endoscopic modality the chronic underperfusion is less than with the transscleral route.

The effects of CP on aqueous secretion are multifactorial. It is widely accepted that a major mechanism of aqueous suppression after CP is coagulative necrosis damage to the secretory ciliary epithelium consequent upon laser energy uptake by the pigmented ciliary epithelium.[3] Further effects are caused by ischaemia; in both TSCP and ECP, some vascular damage occurs as a result of propagation of laser energy from the ciliary epithelium to nearby vessels in the ciliary processes or from tissue disruptions (''pops''), although these