CHRONIC GLAUCOMA: PARADIGM SHIFT

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- Optic disc may not be cupping (*cupping implies concentric enlargement of the original cup*) but sinking (herniating) in its **entirety** in the scleral canal. The terms used 'cupping' and cup- to-disc ratio would be invalid and misleading in chronic glaucoma. Diagnosis of glaucoma would be more accurate if made on observation of the kinking and sloping of blood vessels at the edge of the scleral opening (disc margin) indicating the amount of sinking of the optic disc.

- It is not the holes of the lamina cribrosa but the scleral edge appears to be the site of pathology. Nerve fibers would be severed prior to their entrance in lamina cribrosa when they are still vulnerable to stretching and severing. As a matter of opinion the nerve fibers become secured in the trabecular meshwork and thus immune to damage.

- Neither optic disc nor retina is the primary site of injury in chronic glaucoma. Nerve fibers at the junctional area between the retina and optic disc at level with scleral edge appear to be the site of injury.

- Nerve fibers after making 90 degree angle enter into the prelaminar region. This bending site appears to be site of stretching and severing of the nerve fibers against the scleral edge acting as a blade. Therefore the nerve fibers are destroyed **prior** to their entrance into the laminar portion of the optic disc.

- Arcuate fibers cannot be **selectively** destroyed by raised IOP, ischemia or by any mechanism both in the optic disc or in the retina.

- Nerve fibers originating from peripheral retina which lie deeper (closer to choroid) and in the peripheral part of the optic disc would be destroyed first whereas the central and superficial fibers (closer to the vitreous) would be destroyed last in the event that optic disc is sinking. In sinking the pathology would start from the peripheral part of the disc and would end with the central part and vice versa if cupping was taking place. Ironically, the central and superficial fibers would have been destroyed first if cupping was indeed occurring but this is not the case because the central vision is retained till the end stage in glaucoma.
- As the peripheral fibers are being destroyed the central fibers of the optic disc shift to the peripheral region and move closer to the scleral edge. This shifting of the central fibers to the periphery would result in breaking up of the original cup. Therefore it may be de-cupping rather than cupping of the original cup taking place.

It is not central retinal artery circulation but ciliary circulation supplying the prelaminar area and the border tissue of Elschnig appears to be impaired in chronic glaucoma. High IOP would cause ischemia by directly compressing the blood vessel supplying the border tissue whereas systemic problems indirectly due to impaired systemic and respiratory conditions.

- Chronic glaucoma is a multifactor disease and high IOP is only one of the causative factor. Glaucoma is similar to ischemic heart disease in which multiple factors play their roles. More the risk factors present, more the likelihood of development and severity of glaucoma.

- Normal tension glaucoma(NTG) is more prevalent than high-tension glaucoma because more risk factors are involved in the pathogenesis of NTG.

- If proven that optic disc is sinking then present pressure lowering treatment would become questionable. In this scenario the rational treatment would be to stabilize the sinking disc preferably by surgery.

- It is not optic atrophy or optic neuropathy but depletion of the nerve fibers of the optic disc which would be unique to glaucoma. If there is no depletion of nerve fibers then it would not be glaucoma. In other kinds of optic atrophy the optic disc although shrunken, is flat and not excavated as in glaucoma.

- Nerve fibers are being depleted by mechanical rather than any direct biological process.

- Ocular hypertension is not a benign disease and should be treated especially if other systemic risk factors are also present.

- Normal tension glaucoma is a systemic disease. All those systemic and orbital diseases which could cause ischemia and hypoxia to the border tissue by impairing ciliary circulation. Systemic diseases for example would include poor pumping of the heart, chronic hypotension, chronic anemia, emphysema , sleep apnea and smoking even second hand.

- Why we describe the end stage as a 100% cupped disc when the optic disc is even no longer present!

1. References:

- Hasnain SS. Scleral edge, not optic disc or retina, is the primary site of injury in chronic glaucoma. Medical Hypotheses: (2000) 67, 1320-1325.

- Hasnain SS. Optic disc cupping or sinking in chronic glaucoma? www.hasnaineye.com