The mammalian lens epithelium is the most anterior monolayer of the lens and plays a vital role for the continuous growth; lens fiber differentiation and the maintenance of the lens homeostasis. Lens epithelium being a part of an avascular organ i.e. the lens acts as a barrier between lens and aqueous humor and is responsible for the transport of metabolites and ions across the lens capsule. Biochemically, the lens epithelial cells are the most active cells in the lens and have highest activities of various enzymes. As lens epithelium is the most anterior portion of the lens, it is first site of ocular lens exposed to any sort of insult. Therefore, epithelia is first target site for lenticular damage which leads to lenticular opacification. On the basis of above reasons the present study is performed to know:

1. The sequential events taking place in the cellular integrity of the all three regions of the lens epithelia during cataractogenesis.
2. How these sequential changes taking place in LEp is playing an important role and involved in the cataractogenesis.

Three important types of experimental cataract models were studied to know the extent of sequential changes in relation to the cellular integrity under the progression of opacity in the lens.

1. Sodium selenite (Na₂SeO₃) induced in vivo cataract model (metabolic insult).
2. Ultraviolet (UV) radiation induced in vivo cataract model (photo-oxidative insult).
3. Hydrogen peroxide (H₂O₂) induced in vitro cataract model (oxidative insult)

The changes found in the LEp can be explained in following terms,
I. The histomorphological and ultrastructural studies indicate three major types of nuclear changes during cataractogenesis.

1. Decondensation of chromatin and simultaneous rupturing of the nuclear membrane which leads to the leaking of nuclear material into the cytoplasm.

2. Blebbing or lobeformation of nucleus containing heterochromatin material which leads to the formation of micronuclei.

3. Random enlargement of the internuclear membrane space leads to inpushing of the nuclear material and subsequent degradation of chromatin material.

All these changes in the nuclear morphology are dose-dependent which are increased during the progression of cataract suggest that the normal denucleation process has been accelerated.

II. The cytoplasmic changes observed during the cataractogenesis are,

1. Cytoplasmic vacuolization

2. Enlargement of intercellular spaces

3. Degradation and disalignment of various cell organelles.

All such changes suggest altered cell-cell and cell-fiber interaction along with depleted metabolism in these important tissue of the lens.

III. A constant but gradual decrease in the cell density is also found during progression of opacity. It is suggested that the lens epithelial cell population divides into two distinct groups during cataractogenesis. The first group of cells which are exposed to optimal threshold dose may die while other group of cells which are exposed to subthreshold dose do not die but undergoes mitosis and lead to superimposition. These groups of cells in the LEp are
seen as patches. The patch containing dying cells which forms acellular foci. In hypermature cataract cells may arrange themselves in these two types of groups.

IV. The study indicates two different types of regions at different cellular activity in the same LEp. These regions are superimposition or multilayering and acellular foci. The superimposition of cells is found to be different from the usual multilayering. Superimposition may be the initial phase of the multilayering.

V. The effect of treatment in the three different regions of LEp and its further involvement in cataractogenesis are,

1. The effects on the cells of central region leads to altered critical homeostasis genes (housekeeping genes) which ultimately leads to alter the functions of underlying fiber cells.

2. The effects on the cells of preequatorial region lead to the production of abnormal cells which lead to altered equatorial region cells.

3. The altered equatorial region cells arise from PR. The abnormal cells may contain abnormal proteins or may not differentiate properly. All these changes lead to opacification of the lens.

VI. The gradual decrease in the biochemical parameters is found alongwith the progression of cataractogenesis which is dose or duration-dependent. The decrease in the cell density is not sufficient enough to explain observed decrease. The decrease in the levels of GSH and GR suggests the compromisation between the oxidative stress and antioxidative defence. On the other hand the decrease in the levels of SOD, catalase and GPx leads to increased production of the reactive oxygen species.
Thus, from these observations it may be concluded that all the three regions of LEp are involved in the development of cataract. Due to extensive depletion of \(-\text{SH}\) groups and GSH, lens epithelial cells cannot withstand the oxidative stress. The observed histomorphological changes in the cells indicates the loss of the epithelial viability and death by apoptosis and necrosis. Such changes may be enhanced due to decreased cell-cell or cell-fiber relationships. A distinct phenomenon observed during the study is superimposition of cells which can also take part in the cataractogenesis. These ultimately reflects alteration in the pattern of cellular integrity in all the three regions of LEp and its altered biochemical constituents. This study propose following sequence of events taking place during cataractogenesis.

Please Refer Plate No. 51.
PLATE : 51. Flow Chart of Summary and Conclusion.