

Lens epithelial cells require direct toxic exposure for PCO prevention

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in Athens**

CONTRARY to common belief, toxic chemicals used in the eye to kill lens epithelial cells will not work unless they are specifically directed into the capsular bag under positive pressure, according to new research.

Australian researchers conducted experiments in rabbits' eyes, using de-mineralised water, mitomycin C and Triton-X (alkylaryl polyether alcohol) to test the effect of toxins when using a sealed irrigation system (Perfect Capsule). A control group received the agents without the sealed capsule system.

"Triton-X and mitomycin in a sealed system resulted in normal rabbit eyes, so we knew that we could selectively introduce a poison into the capsular bag," reported Anthony Maloof MD at the 18th International Congress of the Hellenic Society of Intra-Ocular Implants and Refractive Surgery.

The rabbits sacrificed immediately in the control group showed cell destruction and damage in the cornea, anterior chamber and retina, but epithelial cells in the capsular bag were unaffected by the poison.

"Most people think if you put poison in an eye you'll kill lens epithelial cells, but what happens is that lens epithelial cells are the last to go. The first thing to go is the endothelium. When we used a powerful drug like Triton-X there was no endothelium on the cornea at all. The iris was very swollen, and there is retinal damage, but in the capsule there were plenty of lens epithelial cells."

Dr Maloof said that the research showed that most attempts to treat lens epithelial

cells (LECs) are not going to work.

"The greatest effect is on non-lens cells. Why? When the capsule is collapsed and people are injecting into an eye, the fluid just goes around the periphery. If you are going to address lens epithelial cells pharmacologically you need to do it under positive pressure."

He said the LECs do not come into contact with the drug. LECs are also tougher, so drugs must be directed specifically at them in order to work.

"You need positive inflation of the bag to fill the bag, and you can only get that with sealed capsular irrigation. With a controlled delivery system you can deliver a drug into the capsule of a rabbit lens and prevent damage to surrounding structures," he said.

Dr. Maloof suggested that ophthalmologists should think in terms of general capsular opacification and not just PCO. The system targets the prevention of capsular fibrosis, as well as anterior, equatorial and posterior opacification.

The device uses suction to seal the lens capsule, allowing selective irrigation of the capsular bag following phacoemulsification. The surgeon inserts the device through the standard cataract incision after which it retains the irrigating solution within the capsular bag by creating a vacuum seal around the capsulorhexis. It seals the capsular bag by means of a toroidal suction ring connected to a locking suction syringe. Fluid can be injected into the empty capsule via an irrigation/aspiration port.

The system is being used in humans and is currently undergoing an international multi-centre trial. The product has the CE mark

and FDA 510K approval.

Okihiro Nishi MD presented additional data on the new device. He evaluated the potential of the system to prevent PCO using EDTA (ethylenediaminetetraacetic acid). EDTA chelates calcium ions, so that lens epithelial cell adhesion to the lens capsule is damaged, facilitating LEC removal by simple aspiration.

"We injected 10.0 or 45.0 mm EDTA dissolved in viscoelastics into the capsular bag through the sealed capsule irrigator. After three minutes, LECs underneath the anterior capsule were aspirated for three minutes. Eight weeks after surgery, we found significantly less LEC amounts although LEC could not be removed completely. Further technical refinement or the use of another drug may be needed."

Noted pathologist Liliana Werner MD, PhD commented: "We believe that prevention of any form of opacification within the capsular bag, usually in a fibrotic form, will be very important for the long term success of any accommodative IOL. For that, the sealed capsule irrigation system of Dr. Maloof appears to be very promising, and may eventually become an important surgical step that will be incorporated to the standard procedures."

John Kanellopoulos MD concurred, saying that the system showed promise, but needed more research.

"I have seen sketches of this system and I think it is a valid approach. The theory is sound, and it works well in animal models, but we need more results of human trials. I'm looking forward to the results of the multi-

centre trial running at the moment. But with this issue it will take numerous trials over many years to discover exactly what impact this system has. We will get a good idea of its impact on PCO after six months or a year, but the impact of removing epithelial cells on the structure and properties of the capsule will take much longer to assess. We don't know what the impact will be of removing germinal cells, for example, or how it will affect capsular elasticity."

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