Role Of Docetaxel Mems Device In The Treatment Of Diabetic Retinopathy

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ABSTRACT
Diabetic retinopathy is a micro-vascular complication composed of a characteristic group of lesions which occurs due to changes in the retinal circulation. It is increasingly becoming a major cause of blindness throughout the world in the age group of 20–60 years. Diabetic retinopathy is classified into two stages; Non-proliferative and proliferative. Due to the circulation problems, retinal hypoxia occurs leading to Angiogenesis. The new formed fragile blood vessels begin to grow in the retina, vitreous and may leak blood into the vitreous, clouding vision. If left untreated, proliferative diabetic retinopathy can cause severe vision loss and even blindness. The newly developed MEMS(Microelectromechanical system) device contains a microreservoir sealed by a polydimethylsiloxane membrane with a laser drilled aperture. By applying Magnetic field, the membrane deforms and releases the drug. Docetaxel inhibits Angiogenesis by inhibiting cell division and cell proliferation in Proliferative Diabetic Retinopathy and avoids vision loss. Thus Docetaxel improves quality of life of patients suffering with diabetic retinopathy besides treating the ovarian, prostate, liver, renal, gastric,head and neck cancers.

KEY WORDS: Diabetic retinopathy, MEMS device, Docetaxel, Angiogenesis.

INTRODUCTION
Diabetic retinopathy is a micro-vascular complication that occurs due to changes in the retinal circulation and is composed of a characteristic group of lesions found in the retina of individuals having had diabetes mellitus for several years. Diabetic retinopathy is increasingly becoming a major cause of blindness throughout the world in the age group of 20–60 years.
Diabetic retinopathy is classified into two types:
- Non-proliferative diabetic retinopathy(NPDR). It is the early state of the disease in which symptoms will be mild or non-existent. In NPDR, the blood vessels in the retina are weakened causing tiny bulges called microaneurysms. The microaneurysms may leak fluid into the retina, which may lead to swelling of the macula.
- Proliferative diabetic retinopathy(PDR)
It is the more advanced form of the disease, the circulation problems causes hypoxia to the retina. As a result, new fragile blood vessels can begin to grow in the retina and into the vitreous. The new blood vessel may leak blood into the vitreous, clouding vision.
Other complications of PDR include detachment of the retina due to scar tissue formation and the development of glaucoma. If left untreated, proliferative diabetic retinopathy can cause severe vision loss and even blindness.

Biochemical pathways of diabetic retinopathy
The key contributors in the development of Diabetic Retinopathy are increased polyol pathway, activation of protein kinase C (PKC), increased expression of growth factors such as vascular endothelial growth factor (VEGF) and insulin-like growth factor-1 (IGF-1), haemodynamic changes, accelerated formation of advanced glycation endproducts (AGEs), oxidative stress, activation of the renin-angiotensin-aldosterone system (RAAS), and subclinical inflammation and capillary occlusion. Among the all mechanisms, increased production of growth factors, hemodynamic changes and protein kinase -c are responsible for the Angiogenesis.

RECENT ADVANCEMENT
The University of British Columbia recently reported about the development of MEMS (Microelectromechanical system) device. It contains a micro reservoir sealed by polydimethylsiloxane membrane and is capable of releasing drug on demand. By applying the magnetic field, the PDMS membrane with laser-drilled aperture deforms causing the discharge of docetaxel from the reservoir. The biological activity of the drug released was investigated by using two cell lines, HUVEC (human umbilical vein endothelial cells) and PC3 (prostate cancer) cells and cell apoptosis is seen in the cytotoxic assay. The device maintained its pharmacological efficacy for two months.
MECHANISM OF DOCETAXEL IN TREATING DIABETIC RETINOPATHY

Docetaxel binds to tubulin, the protein component of microtubules, and simultaneously promotes assembly and inhibits disassembly of them. Stabilization of microtubules leads to inhibition of cell division (mitosis) and cell proliferation, resulting in cell death.

CONCLUSION

Thus Docetaxel improves quality of life of patients suffering with diabetic retinopathy besides treating the ovarian, prostate, liver, renal, gastric, head and neck cancers.

REFERENCES


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