Top 5 advances in retina care

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Over the past 10 years, there has been a virtual revolution in the management of eye diseases. In no area has this been more apparent than in the subspecialty focusing on the evaluation and treatment of the retina, the light-sensitive structure deep within the eye that senses and directly transmits visual stimuli to the optic nerve and brain.

The five main advances driving this paradigm shift and leading to improved patient outcomes are:

**Number 5 - Advanced Implants**

Age-related macular degeneration (AMD) and retinitis pigmentosa (RP) are conditions that break down the retina and cause drastic vision loss. For those patients with these conditions, there are new technologies and surgical options that may help to overcome their visual deficits. The most recent is the CentraSight Telescope - an implantable telescope that is miniaturized to fit within the human eye. In a twist on traditional cataract surgery, the surgeon removes the cataract in the standard fashion, but then inserts the telescope instead of a typical intraocular lens.

For patients with RP, the Food and Drug Administration (FDA) approved the Argus II Retinal Prosthesis in 2013. It is a visual prosthesis, consisting of an electrode array, implanted on the surface of the retina, coupled with a camera system worn as a pair of glasses. The input from the camera gets transmitted to the implant, which bypasses damaged photoreceptors and relays the information to the optic nerve.

**Number 4 - Improved surgical instrumentation**

Vitrectomy is a surgical procedure involving the removal of the clear gel between the lens and retina. This is commonly performed for a wide range of conditions such as retinal detachments, macular holes, and diabetic vitreous hemorrhages. Historically, incisions were large, 17 or 20 gauge, to allow for access of instruments. These incisions required suturing to re-approximate them in a watertight fashion. In order to reduce the size and increase the precision of the instruments, 23 and 25 gauge instruments were developed. In the early 2000s, complete 23 and 25 gauge systems became commercially available and have since largely replaced the earlier systems. Benefits to the patient include shorter surgical time and smaller, self-sealing or “suture-less” incisions.
Number 3 - Automation in laser photoocoagulation

Laser photoocoagulation therapy has applications in numerous retinal pathologies, including retinal vascular diseases such as vein occlusions and diabetic retinopathy. Laser has traditionally been applied one spot at a time, each application requiring the surgeon's manual aim. In 2005, a semi-automated laser system was approved by the FDA, which delivers either a single shot or a pattern array. This greatly increased the speed and reduced the discomfort of laser delivery. Subsequently, a new laser system has been developed that employs tracking technology. Instead of manually aiming and firing each laser shot, the surgeon uploads previously acquired retinal images of the patient's eye and selects where each laser application should be placed. The system recognizes and registers the retina, even tracking the eye as it moves. At the doctor's prompting, the laser fires at each pre-selected spot with high precision, avoiding areas where laser could be detrimental to vision.

Number 2 - Advances in Imaging (OCT)

Advanced imaging is playing a critical role in healthcare. An imaging modality that has revolutionized the evaluation of the macula, the central retina, is optical coherence tomography, or OCT. At its core, the OCT consists of a light source that, when directed at the retina, scatters and reflects back. The interference of the reflected light helps to formulate cross sectional images, showing macular architecture at a micrometer scale. The original iteration (“time domain”) OCT captures images with a resolution of about 10 micrometers, less than the thickness of a human hair. With further refinement, “spectral domain” OCT has approximately doubled the resolution, to about 4-7 micrometers, or about the width of a strand of spider web silk.

In addition to the OCT, other emerging modalities include multi-spectral imaging, such as the Anodis HRATM. Multi-spectral imaging uses a wide range of light frequencies to acquire photos of the retina and the layer directly underneath it, the choroid. Progressively longer wavelengths penetrate ever deeper into the eye. A single image obtained with multi-spectral imaging yields an array of images at different wavelengths and depths, making it possible to effectively “scroll” through different anatomical layers. What makes multi-spectral imaging truly unique, however, is that it is able to detect oxygenation and highlight pathology related to blood flow. Hemoglobin, the molecule that carries oxygen within the red blood cell, absorbs light at different frequencies depending on whether it is bound to oxygen or not. Utilizing this difference in frequency absorption, multi-spectral imaging maps out where the oxygenated blood is traveling and/or is absent and correlates it to possible disease states.

Number 1 - Advances in vision-saving drugs

As mentioned above, one of the most devastating diseases to affect the macula is AMD. It is estimated to affect over 2 million people in the U.S. alone, ranks as the third cause of blindness globally, and is expected to more than double by 2050. AMD is commonly classified into two broad categories, the slowly progressive “dry” and the highly aggressive “wet”, in which the onset of bleeding and swelling within the macula can lead to sudden, drastic central vision loss. In 2004, the first medicine treating this condition by intraocular injection was approved. It was specifically engineered to reduce the bleeding and swelling at a molecular level, by targeting a growth factor present at abnormally high levels within the eye.

Subsequent compounds within the same family have come to the market, further refining the success rate to over 90%, as defined by preventing vision loss.