Aqueous humour outflow imaging: seeing is believing

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Video Abstract

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Abstract

Over the past decade, a variety of new drugs and surgical techniques have been developed to lower intraocular pressure and treat glaucoma. This trend has reinvigorated interest in understanding how and where aqueous humour outflow occurs. Three main pathways are currently known: trabecular, or **_conventional_**, outflow; uveoscleral, or **_unconventional_**, outflow; and subconjunctival outflow. Current methods for imaging these pathways are at varying stages of development, with conventional outflow imaging being the most advanced. Nevertheless, each route possesses a unique biology that can be leveraged in the quest for more knowledge about aqueous humour outflow. Conventional outflow accounts for approximately 90% of aqueous humour flow under physiologic conditions. Here, imaging methods have focused on capturing structural or flow-based features. Optical coherence tomography has enabled researchers to assess ocular tissue in live human subjects. While tracer-based methods, such as aqueous angiography, have enabled visualization of blood flow. In conventional outflow, growing evidence suggests ocular hypertension may be an expansion of normally low-flow segmental areas. Further research could improve understanding of why intraocular pressure increases in disease and how to lower it by modified drug and surgical approaches. Imaging of the unconventional outflow pathway is much more difficult. In fact, such imaging has never been performed in real time in a living subject. But research points to a few strategies that could help. These include identifying low-flow regions, using large tracer molecules that are less likely to leak out of the conventional pathway, and patience on the part of the observer, as unconventional outflow lags conventional outflow. Better imaging could lead to improved treatment of both hypotony and ocular hypertension. Unlike for the other two routes, there is currently no evidence that subconjunctival outflow directly affects physiologic intraocular pressure. But because of the potential effects on glaucoma surgery and drug delivery, the subconjunctival route could be exploited to improve eye care. Bleb-related surgeries, which are reserved for patients with highly advanced glaucoma, may be able to be enhanced by improving lymphatic outflow. And improved drug delivery through the subconjunctival route could aid the treatment of all eye diseases that require drug therapy. Overall, visualization of how and where aqueous humour outflow occurs is improving. As knowledge and techniques continue to advance, researchers are sure to gain a better understanding of ocular hypertension in glaucoma and how to treat it.