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Case report
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Improvement of optic nerve head perfusion and reversible visual field defect following XEN Gel Stent implant

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Abstract

Background: Patients with juvenile onset ocular hypertension (OHT) have high intraocular pressure (IOP) and may develop early glaucomatous disc damage.

Case presentation: A 26-year-old woman with family history of glaucoma was diagnosed with OHT at age 18. Her vision was 6/6, with a bilateral cup-to-disc ratio of 0.5, normal visual field (VF), and IOP in the mid-teens on 2 topical antiglaucoma medications. The patient started having IOP spikes (20–48 mmHg) in her left eye despite maximum tolerable medical therapy, associated with intermittent headache and nasal step defect on VF test. XEN Gel Stent was implanted and IOP reduced to 10–14 mmHg without medical therapy. Optical coherence tomography angiography showed improvement in optic nerve head (ONH) perfusion density and flux, while the VF defect disappeared.

Conclusion: Improvement in ONH perfusion and reversibility of early glaucomatous VF defect is feasible with prompt XEN Gel Stent implant in juvenile OHT.

Keywords: intraocular pressure, juvenile ocular hypertension, optic nerve head perfusion, visual field defect, XEN gel stent implant

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Penambahbaikkan perfusi kepala saraf optik dan medan penglihatan selepas implantasi stent gel XEN

Abstrak

Latar belakang: Pesakit hipertensi okular juvana mempunyai tekanan intraokular yang tinggi dan berisiko untuk mengalami kerosakan urat saraf mata yang awal.
Pembentangan kes: Seorang wanita berusia 26 tahun yang mempunyai sejarah keluarga mempunyai penyakit glaukoma telah didapati mengalami hipertensi okular pada usia 18 tahun. Penglihatannya masih 6/6 dan nisbah cawan kepada cakera ialah 0.5 pada kedua-dua matanya. Dia telah dirawat dengan 2 ubat anti-glaukoma topikal dan mencapai sasaran tekanan intraokular diperingkat belasan mmHg. Tetapi sejak kebelakangan ini tekanan intraokular telah meningkat kepada 20–48 mmHg, walaupun telah diberi terapi perubatan yang maksimum dan bersimptom: sakit kepala berkala, kurang daya penglihatan dan didapati medan penglihatan merosot pada bahagian nasal. Implantasi stent XEN Gel telah dilakukan dan tekanan intraokularnya berkurangan kepada 10–14 mmHg tanpa memerlukan ubat ubat anti-glaukoma topikal. Tomografi koheren optikal angiografi menunjukkan peningkatan dalam ketumpatan perfusi kepala saraf optik dan fluks, manakala kecacatan medan penglihatan telah hilang.
Kesimpulan: Penambahbaikan dalam perfusi kepala saraf optic dan kebolehbaikan kecacatan medan penglihatan glaukoma yang awal boleh dicapai dengan implantasi stent XEN Gel secara segera dalam kes hipertensi okular juvana.

Kata kunci: hipertensi okular juvana, implan XEN Gel Stent, kecatatan medan penglihatan, perfusi kepala saraf optik, tekanan intraocular

Introduction

Ocular hypertension (OHT) is defined as high intraocular pressure (IOP) of more than 21 mmHg with no anatomical changes to the optic disc or visual field (VF).[1] Juvenile OHT is a variant diagnosed between 3–40 years of age and the risk of developing glaucomatous disc damage in this population is 5% over a mean duration of 5 to 7 years if left untreated.[2] Patients with OHT are often underdiagnosed and undertreated,[3] allowing persistent high IOP to cause structural damage to the retinal nerve fibre layer (RNFL), death of retinal ganglion cells (RGC), and glaucomatous VF defect.[2] Risk factors for OHT progressing to glaucoma include older age, larger cup-to-disc ratio, and raised IOP.[3] Optical coherence tomography angiography

(OCTA) allows quantification of optic nerve head (ONH) perfusion associated with IOP elevation in addition to RFNL measurements to describe the vascular effect of elevated IOP on the ONH.[2,4]

Case presentation

A 26-year-old woman with a strong family history of glaucoma was diagnosed with OHT at the age of 18. Her vision was 6/6 and the cup-to-disc ratio was 0.5 bilaterally. With 2 topical antiglaucoma medications, her IOP reduced from the high twenties to the mid-teens with a normal Humphrey VF test. However, despite being on maximum tolerable medical therapy, the patient started having IOP spikes ranging between 20 and 48 mmHg in her left eye in early 2020. Although there was no drop in vision, she started experiencing intermittent headache and brow pain. A recent Humphrey VF test showed nasal step defect. Selective laser trabeculoplasty failed to lower IOP. She opted for a XEN Gel Stent (Allergan, Irvine, CA, USA) implantation and her IOP reduced to 10–14 mmHg without requiring medical therapy. We compared her ONH perfusion before and after the surgery using the AngioPlex® OCTA ZEISS machine (Carl Zeiss, Heidelberg, Germany), which showed an improvement in ONH perfusion from 44.2% to 45.5%, and gain in flux index by 0.053 (Fig. 1).

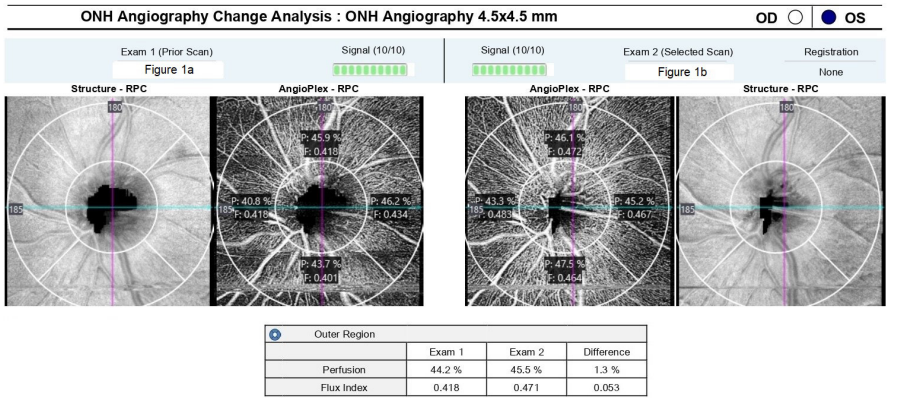

Fig. 1. OCTA of the left eye showing improved ONH perfusion and flux index (*a*) before and (*b*) after surgery. The perfusion of the superior, nasal, inferior, and temporal quadrants of the ONH was 45.9%, 40.8%, 43.7%, and 46.2%, respectively, with an average perfusion of 44.2%. These percentages improved by 0.02%, 2.5% and 3.2% in the superior, nasal, and inferior portion of ONH, respectively. The preoperative flux index was 0.418 in both the superior and nasal quadrants, and 0.401 and 0.434 in the inferior and temporal quadrants, respectively. These values improved in all quadrants.

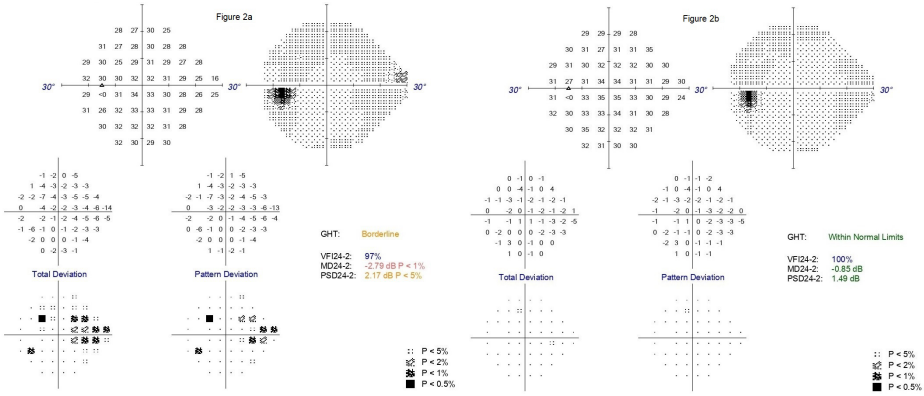

Fig. 2. Left eye Humphrey Visual Field 24-2 analysis (*a*) before and (*b*) after surgery shows resolved nasal step defect after XEN gel stent implantation. The mean deviation improved from -2.79 dB to -0.15 dB with normalisation of the Glaucoma Hemifield Test.

Vision in the left eye remained 6/6 and the nasal step on Humphrey VF disappeared, with improvement in Mean Deviation (MD) from -2.79 dB to -0.15dB and normalisation of Glaucoma Hemifield Test (Fig. 2).

Discussion

It has been postulated that ischaemic changes from elevated IOP may induce axonal apoptosis and subsequently RNFL loss.[4] OCTA aids in accurate quantification of early perfusion changes and vessel density alterations within the optic disc secondary to raised IOP.[2,4] Comparison of ocular perfusion before and after glaucoma filtering surgery has shown that the amount of increase in vessel density is directly proportional to the amount of IOP reduction,[4] thought to be related to reduced lamina cribrosa curvature and improved ONH circulation.[5,6] In our patient, by relieving the mechanical stress at the lamina cribrosa following IOP reduction by 50–70%, the average perfusion pressure improved by 1.3% and flux index increased by 0.053.

There have also been reports of improved VF sensitivity after surgical-related IOP reduction.[7] According to a study, there was a notable increase in RNFL thickness with IOP reduction after glaucoma filtering surgery, which has been attributed to decreased strain exerted on the axons.[5] The damaged RGCs regain their function partly, resulting in reversibility of the VF defect.[8] Our case showed that the nasal step defect was reversible alongside improvement of ONH perfusion with prompt and adequate IOP reduction in this young patient.

IOP reduction is made possible with the use of IOP-lowering medications, laser procedures, and glaucoma surgeries.[7] At present, the use of minimally invasive glaucoma surgery has increased exponentially.[7] The XEN Gel Stent implant

improves aqueous outflow via subconjunctival drainage and has negligible conjunctival handling, minimal scleral exploration during surgery and excellent safety profile.[7] Besides substantial reduction in the IOP, the XEN Gel Stent implant also alleviated the burden of multidrop treatment in this patient.

Conclusion

Improvement in ONH perfusion and reversal of glaucomatous VF defect can be achieved if IOP reduction is attained before the onset of permanent damage.

Declarations

Consent for publication
Informed consent for the publication of the clinical data and images contained in this case report was obtained from patient.

Funding
None to declare.

Competing interests
None to declare. Conflict of interest statement were attached with the manuscript submission.

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