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An Ocular Hypertonic Crisis In A Patient With End-Stage Renal Disease: The Enigma Of Ocular Angle Closure After Hemodialysis: A Case Report

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Abstract:

Title: An ocular hypertonic crisis in a patient with end-stage renal disease : the enigma of ocular angle closure after hemodialysis: a case report.

Introduction: Hemodialysis can affect intraocular pressure (IOP) in patients with end-stage renal disease, but the underlying mechanisms are poorly elucidated. We present the clinical case of an ocular hypertonic crisis in a hemodialysis patient and discuss its implications for the management of hemodialysis patients.

Observation: After a hemodialysis session, a 36-year-old man with end-stage renal disease and type I diabetes developed a more pronounced ocular hypertonic crisis in his right eye. Decreased visual acuity, ocular pain, nausea and headache were among the symptoms. Ophthalmological examination revealed bilaterally elevated intraocular pressure, corneal edema and a narrow anterior chamber, all more marked on the right side. After general and local hypotonic treatment, clinical signs improved, and gonioscopy revealed a closed angle in the right eye and a narrow angle in the left eye .

Discussion: Osmotic fluctuations, variations in the iridocorneal angle and accumulation of toxic substances may be mechanisms contributing to increased intraocular pressure (IOP) in hemodialysis patients. Management of intraocular pressure (IOP) in these patients is crucial to avoid serious ocular complications. For high-risk patients, preventive measures such as peripheral laser iridotomy may be considered.

Conclusion: IOP management in hemodialysis patients is crucial

Keywords:

Hypertonia-hemodialysis-gonioscopy

Introduction:

A crucial parameter to monitor in patients with ocular pathologies, including glaucoma, is intraocular pressure (IOP). IOP can be affected by hemodialysis, a procedure commonly performed in patients with renal failure. Nevertheless, the underlying mechanisms and extent of this link remain poorly elucidated. In this study, we present the case of a patient with end-stage renal disease who experienced an ocular hypertonic crisis after a hemodialysis session, highlighting the enigma of ocular angle closure. The study aims to examine the clinical features of this case and how this might affect the management of hemodialysis patients.

Case report:

The patient was a 36-year-old man with type 1 diabetes complicated by diabetic nephropathy with end-stage renal failure who was receiving hemodialysis and had no notable ophthalmological history.

During his 2nd session, the patient complained of a sudden drop in visual acuity with ocular pain in the right eye (RE), nausea and headache 1.5 hours after the start of the treatment, prompting a visit to the ophthalmological emergency department.

On ophthalmological examination, the patient presented with ocular redness in the right eye, visual acuity at 1/10th, significant corneal edema with areflexic semi-mydriasis with narrow anterior chamber (Von Herick grade 1) and ocular tone at 64mmHg. A rapid examination of the left eye (LE) revealed a white eye with visual acuity of 7/10th, Von Herick grade 2 anterior chamber with incipient cataract and ocular tone at 25mmHg.

After nephrology referral, 60 cc of mannitol were administered intravenously over 20 min, followed by a local treatment consisting of pilocarpine 4% (4 drops/day) and timolol-dorzolamide (2 drops/day). There was a marked improvement, with a reduction in tonus to 32 mmHg RE and 20 mmHg and improvement in clinical signs 6 hours after treatment.

At a follow-up visit 48 hours after the acute crisis, the corneal edema improved and the examination was completed, revealing a bilateral incipient cataract with a closed angle in the RE (grade 0 according to Schaffer's classification) and a narrow angle in the LE (grade 1 according to Schaffer's classification) on gonioscopy, and the ocular tone fell to 20mmHg in the RE and 12mmHg in the LE. The patient benefited from a peripheral iridotomy, and cataract surgery was planned to prevent acute attacks due to angle closure.

Figure 1: Grade 0 angle closure according to the Schaffer classification of OD

Discussion:

Patients on chronic dialysis are associated with several ocular abnormalities, including fluctuating intraocular pressure (IOP), corneal calcification, retinal hemorrhage, desferrioxamine-related retinal toxicity, anterior ischemic neuropathy and optic neuropathy [1]. However, as illustrated by our clinical case, understanding the occurrence of acute ocular angle closure is the major challenge we face.

Indeed, in patients without a predisposition to glaucoma, intraocular pressure may increase by a poorly elucidated mechanism, but the most likely hypothesis is that plasma osmolality decreases rapidly, resulting in an imbalance between aqueous humor and plasma due to the rapid decrease in plasma osmolality and unchanged ocular osmolality during hemodialysis [2]. In addition, eyes with abnormal aqueous humor outflow are at greater risk and more likely to have higher intraocular pressure [3]. However, it remains to be determined why some patients present with angle closure attacks while others do not. The importance of better understanding specific risk factors is underlined by this particularity.

According to Rever et al [4], the depth of the anterior chamber decreased considerably during dialysis, thus reducing the phenomenon of aqueous humor evacuation. These facts mean that acute angle-closure glaucoma can occur in patients with an asymptomatic narrow iridocorneal angle, leading us to believe that the anatomy of the angle plays a decisive role in the occurrence of this complication.

Some studies have suggested that intra-crystalline urea may influence intraocular pressure during hemodialysis. Indeed, the decrease in intra-crystalline urea concentration during hemodialysis may lead to a decrease in intra-crystalline osmolarity. Decreased osmolarity promotes water absorption by the lens, causing it to swell and enlarge.

As a result, the iridocorneal angle can be compressed by the lens, increasing intraocular pressure due to inappropriate aqueous humor outflow [5][6].

In the study by F. Wang et al [7], in the very narrow-angle group, IOP was significantly increased after 2 hours of hemodialysis, whereas in the open-angle and narrow-angle groups, IOP was not significantly increased after 2 hours of hemodialysis. In our case, the angle closure crisis occurred at 1.5 hours. This difference highlights the variability of this phenomenon.

Acute angle-closure glaucoma is an emergency, and medical treatment must be initiated immediately to lower IOP, followed by laser iridotomy, which is difficult in the initial phase due to corneal edema. Oral carbonic anhydrase inhibitors are normally the first-line treatment of Choice, but are contraindicated in end-stage renal failure. Intravenous hyperosmolar agents are the preferred treatment, except that in patients with end-stage renal disease, hemodialysis should be performed prior to mannitol administration to avoid fluid overload [8]. The topical route remains less effective in the initial stage, and does not allow a rapid fall in IOP and hence relief of symptoms, or clarify the cornea for laser iridotomy or possibly surgery.

To avoid this problematic situation, prevention of acute angle closure in patients with renal failure can be achieved by laser peripheral iridotomy (PI) or cataract surgery. Surgical options such as trabeculectomy and Ahmed valve implantation [9] may be considered in cases of uncontrolled intraocular pressure. In addition, compared with topical treatments and trabeculectomy, the Xen Gel Stent offers a minimally invasive alternative to the treatment of open-angle glaucoma by reducing inflammation of the ocular surface [7]. These complementary surgical approaches may be considered for the management of glaucoma in patients with end-stage renal disease.

Even in patients with an extremely narrow iridocorneal angle, intraocular pressure (IOP) rapidly normalized after hemodialysis and returned to pre-hemodialysis levels in the study by Ling et al [11]. Despite the fact that the angle did not reveal total occlusion in the study group, the variations in intraocular pressure (IOP) observed during hemodialysis could be restored after the procedure. Therefore, in patients with complete angle closure, an acute increase in IOP is likely [11].

The case study presented highlights the importance of appropriate awareness and management of ocular complications in hemodialysis patients. The case findings indicate that acute ocular angle closure can occur unpredictably, making the phenomenon even more fascinating clinically and pathophysiologically.

To better understand this phenomenon and improve clinical outcomes and quality of life for these patients, future research will focus on epidemiology, underlying mechanisms, preventive interventions and multidisciplinary management.

Conclusion:

In this case study, a patient with end-stage renal disease experienced an ocular hypertonic crisis following a hemodialysis session, highlighting a crucial issue concerning ocular angle closure. The results suggest that complex mechanisms, such as osmotic fluctuations, variations in the iridocorneal angle and accumulation of toxic substances, may contribute to this IOP increase. To avoid serious ocular complications, such as acute angle-closure glaucoma, IOP in hemodialysis patients must be properly managed. Preventive measures such as peripheral laser iridotomy may be considered for high-risk patients. Further studies are needed to better understand the underlying mechanisms of increased intraocular pressure (IOP) in hemodialysis patients and to find the best management strategies, particularly to solve the conundrum of ocular angle closure.

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