CASE REPORT

Visual Impairment After Haemodialysis

Tiago Maio, José Lemos, Jorge Moreira, Filipa Sampaio, and Sara Pereira

Hospital Pedro Hispano, Matosinhos, Portugal

ABSTRACT

Hypotension is the most frequent complication of haemodialysis. We report a case of acute visual impairment after one session of haemodialysis in a context of an acute optic neuropathy. The immunological and serological studies were negative. The records of hypotension greater than usual after the dialysis session that coincided with the visual complaints strongly suggest the dialysis-induced hypotension is the underlying mechanism of this non-arteritic anterior ischemic optic neuropathy.

ARTICLE HISTORY

Received 23 March 2018
Revised 21 April 2018
Accepted 26 April 2018

KEYWORDS

Hypotension; haemodialysis; visual impairment; acute optic neuropathy; non-arteritic anterior ischemic optic neuropathy

Introduction

Hypotension is the most frequent complication of haemodialysis, occurring in 10–50% of the sessions and it is a significant cause of morbidity and mortality in this group of patients.^{1,2} There are some mechanisms described, the most important is due to a rapid reduction in blood volume during the ultrafiltration.³

To our knowledge, in the literature, since 1986 less than 30 cases of non-arteritic anterior ischemic optic neuropathy (NAAION) as a result of dialysis-induced hypotension had been described. The visual consequences are still poorly recognised. We report this case to draw attention to the visual complaints potentially irreversible in this risk group.

Case report

We present a case of a man with 50 years old, with renal failure secondary to a congenital kidney malformation that had been on renal haemodialysis treatment 3 days every week for the last 40 years.

He presented a 2-day history of sudden painless decrease of visual acuity of the right eye (RE) during dialysis session. He denied having had a similar episode previously. He had no other symptoms. On the neuro-ophthalmologic examination, he presented a relative afferent

pupillary defect on the RE, best-corrected visual acuity (BCVA) was 0.4 in RE and 0.9 in left eye (LE). Anterior segment examination of both eyes was normal. Fundus examination of RE showed loss of definition of limits of the optic disc (Figure 1) and of the LE showed a pallor optic disc, more evident in the temporal sector. (Figure 2). The late phase of the fluorescein angiogram showed in the RE a staining of optic disc (Figure 3) and in the LE a normal fluorescence of optic disc (Figure 4). Optic disc Optical Coherence Tomography (OCT) revealed an increase in average retinal nerve fibre layer (RNFL) thickness of the RE, and a decrease in average RNLF thickness and a generalised loss of the ganglion cell complex (GCC) of the LE (Figure 5). The macular OCT showed subretinal fluid (SRF) in moderate quantity in the RE (Figure 6). Goldmann kinetic perimetry showed in the RE a general reduction on the visual field with incomplete superior altitudinal defect and in the LE with the stimulus size I and II an irregular defect in inferior visual field mainly in the infero nasal sector (Figure 7).

The entire serologic and immunological studies were negative. Serum levels of haemoglobin (10.1 g/dL) was decreased, urea (7.27 mmol/L) and creatinine (0.59 mmol/L) were increased. Tuberculin test was negative, and chest X-ray

Figure 1. Retinography of the RE showing a small optic disc with oedema, more pronounced in the temporal area.

Figure 2. Retinography of the LE showed a pallor optic disc, more evident in the temporal sector, with a cup to disc ratio of 0.2.

Figure 3. Fluorescein angiography of the RE showing a staining of the optic disc in the late phase.

was normal. Orbital nuclear magnetic resonance showed a decrease in the left optic nerve volume, without other pathological findings. Analysing the blood pressure registers before

Figure 4. Fluorescein angiography of the LE showing a normal fluorescence of the optic disc in the late phase.

Figure 5. Posterior segment OCT showing SRF in moderate quantity and increase in average RNFL thickness of the RE; a decrease in the average RNLF thickness and a generalised loss of the GCC of the LE.

Figure 6. Macular OCT of the RE showing SRF in moderate quantity.

and after the dialysis sessions, we found a larger dropout of blood pressure in the day that coincided with the patient's complaints (**Figure 8**).

Figure 7. Goldmann kinetic perimetry showing in the LE with the stimulus size I and II an irregular defect in inferior visual field bigger in the infero nasal quadrant, and in the RE a general reduction on the visual field with incomplete superior altitudinal defect.

Based on the above findings, we concluded that this patient presented an acute NAAION in RE and an optic atrophy probably secondary to a previous episode of NAAION in LE. The hypotension that occurred during and after dialysis sessions is probably in the cause for these events.

Two months after the onset the BCVA was 0.2 in the RE and 0.9 in the LE. The fundoscopic examination revealed pallid and atrophic optic discs. Macular OCT showed reabsorption of the SRF. Optic disc OCT revealed an important decrease in average RNFL thickness and a generalised loss of GCC in both eyes (Figure 9).

Discussion

Patients with chronic kidney disease often also present with anaemia and hypertension, conferring greater susceptibility to ischemic lesions in the optic discs. NAAION triggered by hypotension is described in literature, and it is thought that

Figure 9. Optic disc OCT revealed an important decrease in average RNFL thickness and a generalised loss of GCC in both eyes.

nocturnal hypotension is the mechanism behind the high number of NAAION cases during the sleep period.

Considering that the immunological and serological study was negative, and adding to the known risk factors for NAAION (anaemia and a crowded disc), the relative hypotension during de dialysis session that coincided with visual complaints leads us to strongly consider the hypothesis of NAAION induced by dialysis hypotension.

Previous cases reported in the literature of NAAION induced by dialysis hypotension are listed in the Table 1. Review of the 29 cases identified, including the present case, reveals that the mean age at presentation was 36 years (range: 8 months–72 years) with an equal gender distribution (14 males and 14 females; one case referred as “a child”). Several causes of chronic renal disease have been described. Of

Hemodialysis sessions			
October 2017			
Day	Duration (h)	Arterial pressure (mmHg) before the session	Arterial pressure (mmHg) at the end of the session
2	4:02	157/94	134/82
4	4:03	132/86	134/73
6	4:02	147/88	112/77

Note: visual complaints during dialysis session on day 6.

Figure 8. Average systolic blood pressure of 145 mmHg before dialysis sessions. Systolic blood pressure around 112 mmHg after dialysis session that coincided with the visual complaints.

Table 1. Previous case reports and case series of NAAION as a result of dialysis-induced hypotension.

Study	Age, Gender	Underlying diagnosis	Length of time on dialysis	Unilateral/Bilateral	Onset visual acuity, affect eye if unilateral, RE/LE if bilateral	Final visual acuity, affect eye if unilateral, RE/LE if bilateral	Other features
Servilla, 1986 ⁴	48 y, female	Chronic renal failure of unknown cause	–	Bilateral	–	–	First case-report
Michaelson, 1989 ⁵	23 y, female	Chronic renal failure following post-streptococcal glomerulonephritis	Haemodialysis for unknown period of time, and 2 years in peritoneal dialysis	Bilateral (sequential)	CF; 20/25	–/20/20	Also had optic disc drusen
Haider, 1993 ⁶	53 y, male	Polycystic kidneys	–	Unilateral	6/6	6/6	Partial visual acuity recovery after reversal of the hypotension
Connolly, 1994 ⁷	39 y, male	Congenital urinary tract obstruction	–	Unilateral	20/800	20/100	
Sabeel, 1998 ⁸	40 y, female	–	3 y	Bilateral	No LP/No LP	No LP/No LP (after 6 months)	No notable visual recovery after 2 years.
Jackson, 1999 ⁹	58 y, male	–	–	Bilateral	20/24; 20/200	–	
Basri, 2002 ¹⁰	40 y, female	–	16 y	Bilateral	–	–	4/10; 2/10
Cuxart, 2005 ¹¹	58 y, female	Interstitial nephritis	7 y	Bilateral	2/10; 1/20	–	
Tay, 2009 ¹²	Case 1: 53 y, female. Case 2: 62 y, male. Case 3: 37 y, male	All patients had chronic renal failure of unknown cause	–	Case 1: Bilateral (sequential) Case 2: Unilateral Case 3: Bilateral	Case 1: 6/24; 6/24. Case 2: CF. Case 3: 6/6; HM.	Case 1: 6/6; 6/18 (after 18 months). Case 2: No improvement after 7 months. Case 3: At 4 months follow up, visual acuity remained unchanged.	Case 3: VF of RE: altitudinal inferior defect; fundoscopy bilateral swollen optic discs; crowded discs.
Nieto, 2010 ¹³	Case 1: 26 y, male. Case 2: 56 y, male.	Case 1: Urethral diverticle. Case 2: Unknown cause	Case 1: 20 y. Case 2: –.	Case 1: Bilateral (sequential). Case 2: Bilateral.	Case 1: –/20/200 Case 2: 20/400; HM	Case 1: –/– Case 2: CF/HM	
Prat, 2011 ¹⁴	63 y, female	–	–	Unilateral	HM;	–	
Bartlett, 2011 ¹⁵	42 y, female	Immunoglobulin A nephropathy	20 y	Bilateral (sequential)	No LP/HM	LP/HM	
Buthaina, 2013 ¹⁶	Case 1: 34 y, female. Case 2: 30 y, female. Case 3: 72 y, male.	Case 1: Chronic renal failure secondary to chronic reflux. Case 2: Glomerulonephritis. Case 3: Chronic glomerulonephritis.	–	Case 1: Bilateral. Case 2: Bilateral (sequential). Case 3: Unilateral.	–	–	
Bansal, 2014 ¹⁷	Case 1: 39 y, female. Case 2: 49 y, male.	Case 1: Congenital kidney malformation. Case 2: –.	Case 1: 17 y. Case 2: 11 y.	Both cases were bilateral involvement	Case 1: 6/5; 6/9.5. Case 2: No LP/No LP.	Case 1: 6/9; 6/9. Case 2: 2: LP; 6/9.5	Case 2: crowded optic discs

(Continued)

Table 1. (Continued).

Study	Age, Gender	Underlying diagnosis	Length of time on dialysis	Unilateral/Bilateral	Onset visual acuity, affect eye if unilateral, RE/LE if bilateral	Final visual acuity, affect eye if unilateral, RE/LE if bilateral	Other features
Zazzo, 2015 ¹⁸	Case 1: 2 y, male.	All cases with presented congenital anomalies of the kidney and/or urinary tract.	Case 1: 1 y.	All cases were bilateral	-	-	
	Case 2: 3 m.		Case 2: 3 m.				
	Case 3: 8 y, female.		Case 3: 8 y.				
	Case 4: < 1 y.		Case 4: < 1 y.				
	Case 5: 3 m.		Case 5: 3 m.				
	Case 6: 2 y.		Case 6: 2 y.				
	Case 7: 23 m.		Case 7: 23 m.				
Al-Kaabi, 2016 ¹⁹	5, female	Congenital nephrotic syndrome	-	Bilateral	LP/CF	0.6; CF	
Jain, 2017 ²⁰	45, female		3 y				
				Bilateral (sequential)	6/60; HM	6/60; HM	

Note: y: years; m: months; CF: counting fingers; HM: perception of hand movements; LP: light perception; RE: right eye; LE: left eye; -: not stated; VF: visual fields.

the 16 cases in where the length of time in dialysis was reported, the mean was 9.5 years. A total of 24 cases (82.8%) were bilateral and 5 (17.2%) had unilateral involvement. When reported, the presenting visual acuity was 4/20 or worse in 20/31 (64.5%) eyes. There was visual improvement in 11/26 (42.3%) eyes. The final visual acuity was counting fingers or worse in 11/26 (42.3%) eyes.

In conclusion, most of the cases of NAAION as a result of dialysis-induced hypotension are bilateral, with poor prognosis and therefore causes great morbidity. Knowing that these patients had a greater susceptibility to ischemic optic neuropathy a controlled reduction in blood volume during the ultrafiltration and a regular blood pressure monitorisation could prevent cases like this.

Patients with chronic renal disease can present impaired vision due to uremic optic neuropathy. It is a rare entity, it affects patients with undiagnosed and/or untreated renal failure, and therefore with very high uraemia values (> 35.7 mmol/L), that thought to cause a toxic lesion on the optic nerve. With the quick initiation of the haemodialysis and removal of the metabolites a partial improvement of the visual acuity can occur.

Disclosure of interest

The authors report no conflict of interest.

References

- Orofino L, Marcen R, Quereda C, et al. Epidemiology of symptomatic hypotension in hemodialysis: is cool dialysate beneficial for all patients? *Am J Nephrol*. 1990;10:177–180. doi:10.1159/000168077.
- Henderson LW. Symptomatic hypotension during haemodialysis. *Kidney Int*. 1980;17:571–576. doi:10.1038/ki.1980.67.
- Sulowicz W, Radziszewski A. Pathogenesis and treatment of dialysis hypotension. *Kidney Int*. 2006;70:S36–S39. doi:10.1038/sj.ki.5001975.
- Servilla KS, Groggel GC. Anterior ischaemic optic neuropathy as a complication of hemodialysis. *Am J Kidney Dis*. 1986;8:61–63. doi:10.1016/S0272-6386(86)80156-1.
- Michaelson C, Behrens M, Odel J. Bilateral anterior ischaemic optic neuropathy associated with optic disc drusen and systemic hypotension. *Br J Ophthalmol*. 1989;73:762–764. doi:10.1136/bjo.73.9.762.
- Haider S, Astbury NJ, Hamilton DV. Optic neuropathy in uraemic patients on dialysis. *Eye*. 1993;7:148–151. doi:10.1038/eye.1993.31.
- Connolly SE, Gordon KB, Horton JC. Salvage of vision after hypotension-induced ischaemic optic neuropathy. *Am J Ophthalmol*. 1994;117:235–242. doi:10.1016/S0002-9394(14)73082-X.
- Sabeel A, Al-Hazaa S, Alfurayh O, Alfurayh O, Mikkonen P. The dialysed patient who turned blind during a haemodialysis session. *Nephrol Dial Transplant*. 1998;13:2957–2958. doi:10.1093/ndt/13.11.2957.
- Jackson T, Farmer C, Kingswood C, Vickers S. Hypotensive ischemic optic neuropathy and peritoneal dialysis. *Am J Ophthalmol*. 1999;128:109–111. doi:10.1016/S0002-9394(99)00026-4.
- Basri BA, Shaheen FA. Visual loss in uraemic patients on dialysis: a case report and review of literature. *Saudi J Kidney Dis Transplant*. 2002;13:45–49.
- Cuxart M, Matas M, Picazo M. Acute bilateral visual loss in a haemodialysed patient. *Nefrologia*. 2005;25:703–705.
- Tay E, Andreou P, Graham E, Plant GT. Anterior ischaemic optic neuropathy (AION) associated with post dialysis hypotension. *Neuro-Ophthalmology*. 2009;33:168–173. doi:10.1080/01658100902952598.
- Nieto J, Zapata MA. Bilateral anterior ischaemic optic neuropathy in patients on dialysis: a report of 2 cases. *Indian J Nephrol*. 2010;20:48–50. doi:10.4103/0971-4065.62094.
- Prat NM, Sanchez-Dalmau BF, Faroozan R. Not just for men. *Surv Ophthalmol*. 2011;56:173–177. doi:10.1016/j.survophthal.2010.06.001.
- Bartlett S, Cai A, Cairns H. Non-arteritic ischaemic optic neuropathy after first return to haemodialysis. *BMJ Case Rep*. 2011;bcr0420114072. doi:10.1136/bcr.04.2011.4072.
- Buthaina S. Anterior ischaemic optic neuropathy and dialysis: effect of hypotension. *Oman J Ophthalmol*. 2013;6:64–65. doi:10.4103/0974-620X.111934.
- Bansal S, Ansons A, Vishwanath M. Hypotension-induced blindness in haemodialysis patients. *Clinical Kidney Journal*. 2014;7:387–390. doi:10.1093/ckj/sfu036.
- Di Zazzo G, Guzzo I, De Galasso L, et al. Anterior ischemic optical neuropathy in children on chronic peritoneal dialysis: report of 7 cases. *Peritoneal Dialysis International*. 2015;35(2):135. doi:10.3747/pdi.2013.00330.
- Al-Kaabi A, Haider A, Shafeeq M, A, El-Naggari M, El-Nour I, Ganesh A. Bilateral anterior ischaemic optic neuropathy in a child on continuous peritoneal dialysis. *Sultan Qaboos University Med J*. 2016 November;16 (Iss. 4):e504–507. Epub. 30 Nov 2016. doi:10.18295/squmj.2016.16.04.018.
- Jain M, Srinivasan R, Babu KR, Parchand MS. Sequential development of non-arteritic anterior ischemic optic neuropathy in a patient on hemodialysis. *GMS Ophthalmol Cases*. 2017;1(7):1–5. Doc22 Epub 2017 Sep 1.