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Ocular Findings in Patients with Chronic Renal Failure undergoing Haemodialysis

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A B S T R A C T

The aim of this paper was to evaluate the ocular findings in patients with chronic renal failure (CRF) undergoing haemodialysis (HD). In 64 patients undergoing haemodialysis (30 female and 34 male), aged 24–83 years (mean 58 years) on haemodialysis 1–213 months (mean 47 months) complete ocular examination were performed: visual acuity (VA), intraocular pressure (IOP), biomicroscopic examination and fundoscopy. On right eye sixty-nine percent of patents had VA 0.6 or better, and on left eye 84% of patients had VA 0.6 or better. Mean IOP before dialysis was 15 mmHg and after dialysis was 14 mmHg. In 9 patients (14%) we found corneo-conjunctival calcium deposits. No correlation of ocular calcification and parathyroid hormone (PTH) level or calcium and phosphate product were observed. 39 (60%) patients had cataract. Hypertensive vascular changes were seen in 44 (68%) patients and in 6 (7%) patients age-related macular degeneration. Seven patients had diabetes mellitus and in 5 diabetic retinopathy was observed. Patients with CRF or who are receiving HD represent unique group of patients. Pathologic change could be found in many tissue and organs, therefore we suggest ocular examination more frequently in dialysis patients.

Key words: *chronic renal failure, haemodialysis, ocular findings*

Introduction

Chronic renal failure (CRF) is an irreversible deterioration of renal function. It is characterised by a numerous disorders that involve many organs: bone, heart and blood vessels, periferal nerves etc. In dialysis patients some disorders could be consequence of the dialysis treatment per se. The most common cause of CRF is diabetic nephropathy, followed by hypertensive nephroangiosclerosis and various primary and secondary glomerulonephropaties. Pathologic changes of many organs could be also the consequences of these diseases. One of the most important complication of chronic renal failure is disturbance of mineral metabolism, i.e. secondary hyperparathyroidism. Common feature of mineral metabolisam disturbance in CRF is soft tissue calcification. The pathogenesis of this calcification is not completely understood but ocular calcifications are among the most frequently observed. The visual sistem could be adversely affected not only by pathologic calcification than also by by other disturbance in CRF and haemodialysisi per se. Therefore the goal of our study was to evaluate the ocular changes in chronic haemodialysis patients.

Glaucoma is one of most important cause of blindness worldwide is impotrant to observe IOP in dialysis patients especialy in patients with glaucoma. Changes in haemoconcentration, plasma colloid-osmotic pressure, plasma osmolarity during HD could be registrated. It is important to reveal their influence on IOP. Posterior eye segment pathology, according to main causes of CRF, could be hypertensive vascular changes and diabetic retinopathy[1–15].

Patients and Methods

In our study we included 64 patients, 30 females and 34 males. Mean age of patients was 58 years (range, 24–83 years). Duration of HD ranged from 1 to 213 months (mean 47 months). All patients were on haemo-

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dialysis 3 times a week, 4 hours; bicarbonate dialysate was used with 1.5 mmol/l Ca concentration. Most of the patients were on calcitriol therapy (up to 0.5 μg per day) and calcium carbonate was used as phosphate binder (up to 4 g per day). Heparin was used during haemodialysis in all patients in a dose up to 4000 i.u. In all patients we performed ocular examination which include visual acuity (VA), intraocular pressure (IOP), biomicroscopic examination, fundoscopy. Visual acuity was assessed with Snellen chart. We measured IOP using Goldmann aplanation tonometry half an hour before and half an hour after HD treatment. On slit lamp we examined corneal and conjuctival calcium deposits. We used Porter and Crombie[1] method for gradation of calcium deposits. Transparency of lens was observed on slit lamp and classified according to the lens opacities classification system III (LOCS III)[16] For ocular background we used direct and indirect fundoscopy and fundus photography. Intact parathyroid hormone (PTH) level (normal range 1–64 μg/l), and calcium (Ca) (normal range 2.25–2.6 mmol/L) phosphorus (P) (normal range 0.64–1.35 mmol/L) level were detected and and calcium and phosphorus product calculated. The aim was to find correlation between the amount of calcium deposits on cornea and conjunctiva and serum levels of PTH, Ca, P, and Ca x P product.

Results

Sixty-nine percent of patients had visual acuity 0.6 or better on right eye. On left eye 84% patients had VA 0.6 or better. In our group we did not have patients with glaucoma. IOP before treatment ranged 11–20 mmHg (mean 15 mmHg) and 11–20 mmHg (mean 14 mmHg) after the treatment so we did not find significant changes IOP during HD, but we had mild decrease in IOP (Table 1). One patient (F) developed acute elevation of IOP on left eye, 41 mmHg 7 months after beginning of HD.

TABLE 1
IOP BEFORE AND AFTER DIALYSIS

	Before dialysis	After dialysis
Range	11–20 mmHg	11–20 mmHg
Mean	15 mmHg	14 mmHg

In 9 (14%) patients we found corneo-conjuctival deposits. They were mostly located in superficial subepithelial part of corneal limbal area as well in paralimbal nasal and temporal part of conjunctiva in horizontal meridian from 9 to 3 o´clock According to Porter and Crombie classification they were mostly mild to moderate (Table 2). We did not find significant corneal edema. Central parts of the cornea was clear. In five patients with calcium deposits we also found higher value of serum PTH. Sixteen patients had higher values of serum PTH but without calcium deposits (Table 3).

TABLE 2
GRADING CALCIUM DEPOSITS (GRADE 0–5)

Grade	0	1	2	3	4	5
Patients	55	3	2	3	1	0

TABLE 3
CALCIUM DEPOSITS AND VALUE OF PTH

Ca deposits	Total	MV	SD
With	5	342.6	278.0
Without	16	342.7	327.0

When we calculated the product of serum calcium and phosphorus, we found that forty-five patients had high level of Ca x P but no deposits. Nine patients had corneo-conjuctival calcium deposits and high level in Ca x P (Table 4). We did not find statistically significant correlation between calcium deposits and level of PTH, nor calcium deposits and value of Ca x P using Kruskal-Wallis test.

TABLE 4
CALCIUM DEPOSITS AND VALUE OF CA x P

Ca deposits	Total	MV	SD
with	9	4.3	0.9
without	45	3.8	1.1

Thirty-nine patients had cataracts. In twenty-nine patients (45%) we found initial form and in 10 (15%) patients we found advance form of cataracts according to LOCS III classification (Table 5). On posterior eye segment we found hypertensive vascular changes in 44 (68%) patients. Most patients had mild to moderate hypertensive vascular changes. Six patients had advanced vascular sclerosis (Table 6). At the Department for haemodialysis were 7 patients with diabetes mellitus which is also a important cause for HD. We found nonpropliherative diabetic retinopathy in 4 (6%) patients, propliherative diabetic retinopathy in 1 (1.5) patients. Three (4%) patients were treated by argon laser photocoagulation (Table 7). In 6 (7%) patients we found aged-related macular degeneration (ARMD).

TABLE 5
CATARACT (LOCS III)

$<NC_2C_2$	$>NC_2C_2$
29 (45%)	10 (15%)

TABLE 6
HYPERTENSIVE VASCULAR CHANGES SCHEI

I	II	III	IV
18 (28%)	20 (31%)	5 (7%)	1 (1%)

TABLE 7
DIABETIC RETINOPATHY

Diabetes	7 (10%)
Nonprolipherative diabetic retinopathy	4 (6%)
Prolipherative diabetic retinopathy	1 (1.5%)
Argon laser photocoagulation	3 (3%)

Discussion

Patients with end stage renal disease (ESRD) undergoing haemodialysis represent specific group of patients who have more than one disease and therefore should be carefully examined. About 80% of patients had visual acuity 0.6 and better. In our study we had two patients who were blind to one eye due to traumatic injury. Soft tissue calcifications are often seen in CRF patients, moreover due to increasing age and longevity of haemodialysis and better sophisticated diagnostic techniques, pathologic extraskeletal calcifications could be find in every haemodialysis patients. The pathogenesis is not completely understood. It was thought that it represent dystrophic, passive calcification due to physical-chemical processes. But today we know that is is also a regulated process modulated by various genes and proteins, i.e. osteocalcin, osteoponitn etc. Ocular calcifications (corneal nad conjunctival) are the most comon metastatic calcification in patients with CRF and on HD. Patients with corneal calcifications could complain of a gritty sensation and in patients with conjuctival calcifications acute injction and inflammation of conjuctiva (»red eye syndrome) could be find. Calcium deposits mainly consist calcium phosphat salts. There are some specific reasons in pathogenesis of ocular calcifications is not fully understood. Some authors suggests that calcium deposits are more likely to perciptate at cornea and conjuctiva due to loss of CO2 from that tissue with rise in pH which is ideal for precipitation of calcium phosphat salts in the presence of high values of serum calcium phosphat.[1,2] It is also possible that some kind of corneal degeneration or minor corneal and conjuctival trauma have significant role in deposit formation. Vunerability can be result of decrease of tear secretion during each haemodialysis treatment[5–8]. We find 9 patients with corneo-conjuctival deposits which are grade 1–4 and duration of HD in this patients were between 2–12 years (mean 7 years). No correlation of PTH level or Ca x P product level were found. It is in agreement with well known fact that pathologic calcifications is not only due to increased level of calcium and phosphorus (i. e. passive process). It is active process yet not completly understood.

In our study we found no significant implication on visual acuity in patients with corneo-conjuctival deposits because the deposits were mild to moderate. Deposits are placed in limbal area and only in later can have implication on visual acuity. In three patients who complained of itching we revealed minute corneal and conjunctival erosions after staining with fluorescein dye. There were no significant changes in IOP, only with slight decrease in IOP during HD. One patient, 74 year old woman, has developed acute rise in IOP after 7 months on dialysis and she was admitted to our clinic. Before that elevation we measured IOP three times on our clinic during 7 months and values were between 11–13 mmHg for both eyes. She received medical therapy for month and IOP values were between 9–15 mmHg. After that she was without therapy with values of IOP between 11–16 mmHg. Exact mechanism of changes of IOP during HD is not fully understood, so we assumed that elevation of IOP during haemodialysis is multifactoriel[11–13,15.] Patients with lower values of IOP could develop acute elevation in IOP. Some studies demonstrated decrease in IOP during HD. Changes in plasma colloid-osmotic pressure could be responsible for intradialytic decrease in IOP. Colloid-osmotic pressure is higher during HD due to decrease in plasma volume owning to removal of water from plasma. To correct this imbalance water from interstitial spaces and also aqueous humor move to plasma. So we had decrease in IOP[14]. Important role as well is production and outflow of aqueous humor. In eyes with impair aqueous outflow and shallow anterior chamber we could observe increase in IOP. For intradialytic increase in IOP could be responsible post dialitytic urea rebound (PDUR)[17]. Findings on ocular background are correspondent with main cause for HD. Forty-four patients have hypertensive vascular changes. Seven patients have diabetes and all have diabetic retinopathy. ARMD we found in 6 patients and they are from older group of patients. Ocular background examination is very important in these patients because we can reveal early changes on retinal vessels which can also helps in systemic evaluation of disease, efficiency of treatment, compliance with medication and progression of disease[18–21].

In conclusion, we suggest ocular examination for all patients with CRF especially before starting with HD treatment. It is necessary to prevent any ocular pathology in dialytic patients because every deterioration in visual system can have great implication in everyday life and social ability of dialytic patients. Patients undergoing HD are very complex we suggest multidisciplinary approach to patients on haemodialysis

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OČNE PROMJENE KOD BOLESNIKA S KRONIČNIM ZATAJENJEM BUBREGA NA HEMODIJALIZI

S A Ž E T A K

Cilj ovoga rada je evaluacija očnih promjena kod bolesnika s kroničnim zatajenjem bubrega na hemodijalizi. Kod 64 bolesnika (30 žena i 34 muškarca) s kroničnim zatajenjem bubrega učinjen je očni pregled: vidna oštrina, intraokularni tlak (IOT), biomikroskopski pregled, fundoskopija. Vidna oštrina na desno oko kod 69% bolesnika je bila 0.6 i bolja, dok na lijevo oko 84% bolesnika imalo vidnu oštrinu 0.6 i bolju. Srednja vrijednost pola sata prije dijalize bila je 15 mmHg, a pola sata nakon dijalize 14 mmHg. Kod 9 (14%) bolesnika našli smo korneo-konjuktivalne depozite. Nije nađena povezanost između prisutnosti kalcifikata na rožnici i spojnici te vrijednosti paratiroidnog hormona (PTH) i umnoška vrijednosti kalcija i fosfora. Kod 60% bolenika nađena je katarakta. Na očnoj pozadini nađene su u 44 bolesnika hipertenzivne promjene i u 6 bolesnika senilna makularna degeneracija. Sedam bolesnika je imalo dijabetes, a kod 5 je nađena dijabetička retinopatija. Bolesnici s kroničnim zatajenjem bubrega na hemodijalizi čine posebnu skupinu bolesnika. Patološke promjene nalazimo na mnogim tkivima i organima, stoga savjetujemo očni pregled kod dijalitičnih bolesnika u kraćim vremenskim razmacima.