

2nd Department of Ophthalmology, Department of Clinical Analytics
Medical University of Lublin

ANNA MATYSIK, DARIUSZ DUMA, MAREK GERKOWICZ,
JANUSZ SOLSKI, MARIA LEWANDOWSKA-FURMANIK

*Catecholamine levels in subretinal fluid and blood of patients
with rhegmatogenous retinal detachment*

Retinal detachment consists in separation of neurosensoric part of the retina from RPE (retinal pigment epithelium). In the newly formed space subretinal fluid accumulates whose composition and origin are subject to numerous investigations. It is clear today that components of subretinal fluid derive from the blood circulating in blood vessels of retina and chorioid, from vitreous humour and elements of the retina and in the pathogenesis the existence of slight intensity inflammation is taken into account. Subretinal fluid contains a number of biologically active substances whose concentration may change depending on duration and extent of detachment. The available literature does not provide any data on the concentrations of catecholamines in subretinal fluid.

The chief and best known catecholamine of vertebrates' retina is dopamine (horizontal and amacrine cells). Dopamine receptors are present in all the retinal neurons and hence amine is believed to accomplish many functions, some of which being unknown up to date. It is known to take part in the growth of retinal neurons, to be responsible for regulating contrast sensitivity. It may also have paracrine action changing camp level in the cytoplasm of photoreceptors (3). There is also considered the role of catecholamines in different kinds of pathologic processes occurring in the retina. It has, among others, been experimentally shown that more frequent occurrence of cystoid oedema of macula in lensless eyes may be caused by higher adrenalin concentrations in the retinas of eyes with removed lenses (2).

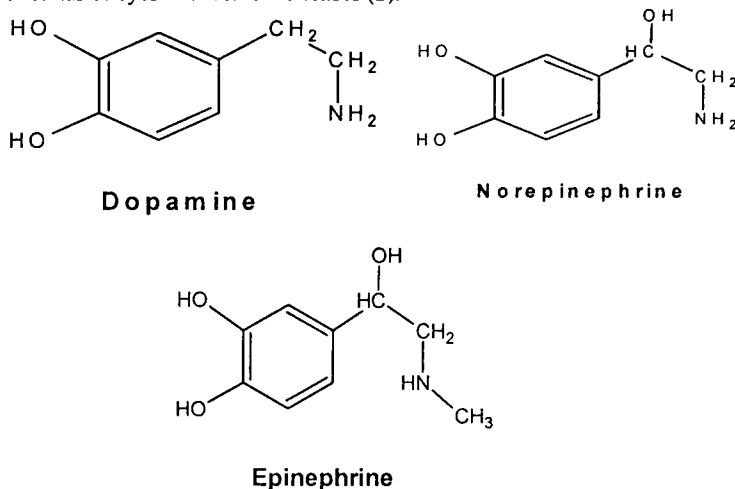


Fig. 1. Chemical structure of catecholamines

As it has been shown by investigations so far vertebrates' retina is rich in dopamine (DA) playing a significant role in the mechanisms of generation and modulation of neural impulses as well as noradrenaline (NA) and adrenaline (A), which are compounds with potentially vasomotor action (Fig. 1) (1,2,3).

The aim of the study was to examine the level of the above-mentioned catecholamines in subretinal fluid and to compare it with their level in blood serum of patients with RPE retinal detachment, which could facilitate the determination of catecholamines origin in subretinal fluid.

MATERIAL AND METHODS

Examinations were performed in 12 patients treated at the 2nd Ophthalmology Department of the Medical University of Lublin from June 2001 to July 2002 because of rhegmatogenous retinal detachment. The study group comprised six men and six women aged from 24 to 74 years. Eleven of the patients were generally healthy, one had arterial hypertension. The duration of detachment ranged from 4 days to 3 months and on average amounted to 2 weeks. In six patients retinal detachment was found involving 2 quadrants and in the remaining six detachment was complete, i.e., in all the 4 quadrants. Blood for examinations was collected an hour prior to surgery from the ulnar vein. Subretinal fluid was taken intraoperatively, using Mądroszkiewicz's method, to cooled test-tubes containing EGTA and reduced glutation. In order to remove cellular elements samples of blood and subretinal fluid were centrifuged at 4°C at 3,000 rot./min and then stored at -20° till the day of determinations. The concentration of catecholamines (KA) in the plasma and subretinal fluid was determined with the method of high-pressure liquid chromatography with electrochemical detection (HPLC-ED) after earlier KA extraction from aluminium oxide (5).

Statistical analysis was performed using Statgraphics ver. 6.0 software.

RESULTS

Obtained results are presented in Figure 2 and Table 1. No statistically significant differences were shown between concentration values of catecholamines in the subretinal fluid and blood plasma. Besides, no significant correlations have been found between concentrations of the particular catecholamines and parameters characterizing clinical condition of patients (age, extent of detachment, duration of detachment).

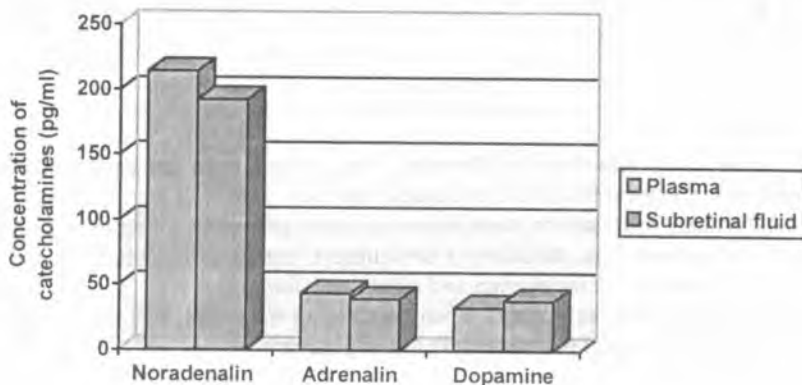


Fig. 2. Comparison of concentration levels of catecholamines in the plasma and subretinal fluid

Table 1. Catecholamines concentrations in the plasma and subretinal fluid (SRF) of patients with rhegmatogenous retinal detachment, p – statistical significance. NS – lack of statistically significant differences

	Noradrenalin (pg/ml)	Adrenalin (pg/ml)	Dopamine (pg/ml)
Plasma	214.3 ± 42.1	43.7 ± 12.4	32.8 ± 18.5
Subretinal fluid (SRF)	192.6 ± 36.5	39.2 ± 11.8	37.9 ± 21.3
p	NS	NS	NS

DISCUSSION

Adhesion of RPE appositions and the neural part of the retina is in physiologic conditions maintained by negative pressure, viscous mucopolysaccharides in the subretinal space and electrostatic forces. In pathologic conditions the blood-retinal barrier which regulates the passage of molecules into the retina gets damaged. This barrier is maintained by tight junctions that exist between the endothelial cells of the retinal vessels and similar tight junctions in RPE. Thus, the retinal vessels are impermeable to the passage of molecules greater than 20–30,000 Da, and compounds with small molecules such as glucose and ascorbate are transported due to facilitated diffusion (1, 2). Transport of substances inside the retina is bidirectional: from the choriocapillars to the retina and in the opposite direction. Correct transport is necessary for maintaining proper position and function of the retina. Essential role in the transport of various compounds into the retina and outside it is played by retinal pigment cells, which have adrenergic α and β type receptors (2, 4). Receptors of the adrenergic system are also present in other retinal layers accomplishing a number of important functions, among others, in autoregulation of blood flow in the retina (2).

Considering the origin of catecholamines in the subretinal fluid examined by us it should be assumed as the most probable that they mainly derive from the blood and permeate to subretinal fluid through damaged blood-retinal barrier. The release of catecholamines from damaged retina seems to be their hardly significant source in the subretinal fluid (e.g., mean values of dopamine levels in animal retina range from 1 to 8 nmol/g (3)). In our investigations we have not found any tendency to accumulate catecholamines progressing during detachment or to the increase of their concentration in bigger detachments. However, discovering the action of catecholamines and other neuromediators in the cells of detached retina may help in the understanding of its malfunctioning, but calls for further investigations.

CONCLUSIONS

1. No statistically significant differences were found between concentrations of catecholamines in the subretinal fluid and blood plasma.
2. No significant correlations were shown between parameters characterizing clinical condition of patient (age, duration of detachment, extent of detachment) and catecholamines concentration in the plasma and subretinal fluid.
3. Most probably, the source of catecholamines in the subretinal fluid of patients with rhegmatogenous retinal detachment is blood plasma.

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SUMMARY

The aim of the study was determination of the level of catecholamines: dopamine, noradrenaline and adrenaline in the subretinal fluid and blood plasma of 12 patients operated on for rhegmatogenous retinal detachment. The method of high-pressure liquid chromatography with electrochemical detection was used. No significant differences in the levels of catecholamines have been found in the subretinal fluid and blood plasma, which seems to indicate mainly plasmatic origin of catecholamines contained in the subretinal fluid. No significant correlations between patient's clinical condition and catecholamines concentration in the plasma and subretinal fluid have been shown, either.

Poziom katecholamin w płynie podsiatkówkowym i krwi u chorych z otworopochodnym odwarstwieniem siatkówki

Celem pracy było oznaczenie poziomu katecholamin: dopaminy, noradrenaliny i adrenaliny w płynie podsiatkówkowym oraz w osoczu krwi 12 chorych operowanych z powodu otworopochodnego odwarstwienia siatkówki. W tym celu zastosowano metodę wysokociśnieniowej chromatografii cieczowej z detekcją elektrochemiczną. Nie wykazano istotnych różnic w poziomach amin katecholowych w płynie podsiatkówkowym i osoczu krwi, co wydaje się wskazywać na głównie osoczowe pochodzenie amin katecholowych zawartych w płynie podsiatkówkowym. Nie wykazano ponadto istotnych zależności między stanem klinicznym chorego a stężeniem katecholamin w osoczu i płynie podsiatkówkowym.