Is lipoprotein subfraction analysis in patients in chronic hemodialysis reasonable? - A pilot study

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Introduction

Background: Patients with end-stage renal disease (ESRD) exhibit high morbidity as well as mortality for atherosclerotic cardiovascular diseases (CVD). Apart from other atherosclerosis risk factors, the research is now being directed towards investigating lipoprotein classes and subclasses as well as on the possible role of small dense LDL and small HDL particles in atherogenesis.

Objectives

We investigated differences in individual lipoprotein classes and subclasses in ESRD patients under chronic high volume hemodiafiltration (HV-HDF) in comparison with control group as well as to the prognosis of patients.

Lipoprint(TM) Quantimetrix system

Source: Atherosclerosis Research Lab

Methods

Methods: 57 patients and 50 controls were enrolled into the study. We analysed HDL and LDL subfractions using the Quantimetrix Lipoprint(TM) system. Subfractions were correlated with selected clinical-biochemical parameters including risk factors for atherosclerotic CVD at the beginning of and 5 years after follow-up.

Table 1 Lipoprotein profiles in the HV-HDF and CON groups

Lipoprotein subfraction	HV-HDF group (n = 57)	CON group (n = 50)
VLDL	35.4 ± 5.6 [a]	24.8 ± 6.7***[b]
Total LDL	39.5 ± 8.5	53.5 ± 7.2***
- IDL (IDL_A-IDL_C) [c]	30.3 ± 4.6	25.3 ± 5.2***
- large LDL (LDL_1-LDL_2)	7.5 ± 4.6	25.6 ± 6.2***
- small LDL (LDL_3-LDL_7)	0.0 (0.0 - 2.4)*	1.4 (0.7 - 3.7)
sum of HDL fractions	24.4 ± 4.9	21.4 ± 6.4*
- large HDL (HDL_1-HDL_3)	44.5 ± 10.6 [d]	21.8 ± 6.9 [d]***
- intermediate HDL (HDL_4-HDL_7)	37.7 ± 7.0 [d]	43.1 ± 3.5 [d]***
- small HDL (HDL_8-HDL_{10})	17.8 ± 5.3 [d]	35.4 ± 8.0 [d]***

[a] mean ± SD (percentage of cholesterol); [b] - *p < 0.05, **p < 0.01, *** p < 0.001 (unpaired t-test); [c] - subscripts denote the respective fraction of the lipoprotein class determined using the Lipoprint kit; [d] - percentage of HDL cholesterol, * – median (Q1-Q4) ; HV-HDF – high volume haemodiafiltration, CON – control group

Table 2 Lipoprotein profiles of survivors and non-survivors

Lipoprotein subfraction	survivors (n = 14)	non-survivors (n = 33)
VLDL	35.1 ± 5.2 [a]	35.0 ± 5.9 [b]
Total LDL	39.5 ± 4.5	40.0 ± 2.5
- IDL (IDL_A-IDL_C) [c]	31.2 ± 5.2	30.2 ± 4.5
- large LDL (LDL_1-LDL_2)	7.0 ± 4.2	7.8 ± 4.4
- small LDL (LDL_3-LDL_7)	0.0 (0.0 – 1.9)*	0.6 (0.0 – 2.9)
sum of HDL fractions	24.9 ± 4.7	24.2 ± 5.0
- large HDL (HDL_1-HDL_3)	44.5 ± 10.0 [d]	44.2 ± 9.2 [d]
- intermediate HDL (HDL_4-HDL_7)	37.4 ± 6.5 [d]	37.7 ± 4.9 [d]
- small HDL (HDL_8-HDL_{10})	18.0 ± 5.3 [d]	18.0 ± 5.4 [d]

[a] - mean ± SD (percentage of cholesterol); [b] - *p < 0.05, **p < 0.01, *** p < 0.001 (unpaired t-test); [c] subscripts denote the respective fraction of the lipoprotein class determined using the Lipoprint kit; [d] percentage of HDL cholesterol, * – median (Q1-Q4)

Tab3 Lipoprotein profiles in survivors at the baseline and follow-up:

Lipoprotein subfraction	baseline HV-HDF	5 year follow-up
VLDL	33.9 ± 6.5 [a]	18.4 ± 7.2**[b]
Total LDL	42.8 ± 7.1	61.7 ± 10.7**
- IDL (IDL_A-IDL_C) [c]	32.7 ± 6.8	37.3 ± 11.5
- large LDL (LDL_1-LDL_2)	6.9 ± 3.9	16.2 ± 7.3**
- small LDL (LDL_3-LDL_7)	0.0 (0.0 - 2.7)*	4.1 (0.0 - 17)*
sum of HDL fractions	24.1 ± 5.2	20.7 ± 5.8*
- large HDL (HDL_1-HDL_3)	46.5 ± 8.8 [d]	29.7 ± 8.6 [d]***
- intermediate HDL (HDL_4-HDL_7)	36.4 ± 6.5 [d]	44.9 ± 4.5 [d]**
- small HDL (HDL_8-HDL_{10})	17.2 ± 4.0 [d]	25.4 ± 11.2 [d]**

[a] mean ± SD (percent of cholesterol); [b] - *p < 0.05, **p < 0.01, *** p < 0.001 (unpaired t-test); [c] subscripts denote the respective fraction of lipoprotein class determined by Lipoprint kit; [d] percent of HDL cholesterol, * – median (Q1-Q4); HV-HDF – high volume haemodiafiltration

Source: Atherosclerosis Research Lab

Results

Results: Fourteen patients survived the 5-year follow-up. Follow-up results revealed a shift toward smaller HDL subfractions. In apoB lipoproteins, there was a shift of cholesterol from VLDL to IDL and LDLs. Hypolipidaemic therapy did not influence lipoprotein profiles in HV-HDF patients.

Conclusion

1. HV-HDF patients exhibited specific lipid profiles with elevated TAG, low HDL and LDL and higher content of cholesterol in remnant particles (VLDL and IDL) at the expense of large LDL. HDL subfractions were linked to the number of risk factors for CVD in the control group only.

2. Baseline lipoprotein profiles did not differ between survivors and non-survivors. Non-survivors had higher CRP and lower HDL-C.

3. During the 5 year follow-up period, cholesterol in the HDL particles and apoB lipoproteins of survivors redistributed towards smaller particles, thus resembling the profiles of non-dialysed patients.

References

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