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AVF volume blood flow reduction in NYHA III patients—is it too late?

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Background and Aims: Heart failure (HF) with preserved / high cardiac output (CO) is a well-known syndrome in patients with high-flow AVF. However, the threshold for classifying an AVF as high-flow is currently undefined. Cardio-fistular recirculation (CFR) is often used as a criterion, with values greater than 25-30% considered cardiotoxic and associated with adverse outcomes. Additionally, CFR is one of the few easily modifiable risk factors through surgical reduction of AVF volume blood flow (Qa).

The study aimed to evaluate the extent of involution of heart structural and functional changes following Qa reduction.

Method: A prospective cohort study included 86 adult HD patients who met the inclusion criteria: HF with preserved / high CO, CFR > 25%, eKt/V > 1.2. Non-inclusion criteria: arrhythmias (except grade I AV block), valvular disease (except mitral regurgitation I-II).

Patients were divided into two groups according to the severity of symptoms: NYHA I-II (N = 39) and NYHA III-IV (N = 47).

All patients underwent a thorough examination, Qa assessment and ECHO-CG with tissue Doppler on the interdialytic day immediately prior to surgery. Qa reduction was achieved by external PTFE banding, PTFE graft segment placement or aneurysmorrhaphy (in case of coexisting AVF aneurysm). Long-term results were evaluated at 6 months after surgery. As the aim was to evaluate the dynamics, patients who died during follow-up, underwent conversion of KRT, or had a change in vascular access were excluded.

Results: Table 1 presents the descriptive statistics of the patients prior to surgery.

Both groups of patients showed a significant decrease in Qa, CO, cardiac index, end-systolic and end-diastolic volume indices, and LV myocardial mass index, while EF remained unchanged (data not shown). At the same time, there were no significant differences in the dynamics of the above parameters (group*time interaction in the mixed-effects model).

Fig. 1 shows that there was a significant group*time interaction: there was a significant difference in CFR before surgery ($p = 0.001$), but not after ($p = 0.958$). In both groups, CFR was adjusted to achieve optimal values.

The E/A ratio was not different before the surgery ($p = 0.209$), but it was different after the surgery ($p < 0.001$). NT-proBNP levels were higher in the NYHA III-IV group both preoperatively ($p < 0.001$) and postoperatively ($p < 0.001$). We have observed a similar pattern in the dynamics of the PASP as well ($p < 0.001$ at both time points).

The likelihood of complete weaning from CHF therapy at 6 months after Qa reduction is almost twice as high in the NYHA I-II group (RR = 1.93 [95% CI 1.2; 3.18], $p = 0.009$).

Conclusion: Defining AVF as high-flow based solely on Qa value is not accurate. Instead, it is more appropriate to define cardiotoxicity based on both CFR and the severity of clinical symptoms. Patients in NYHA III-IV benefit less from Qa reduction than patients in NYHA I-II and are more likely to retain diastolic dysfunction and pulmonary hypertension. We recommend reducing Qa in the early stages of HF.

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Table 1: Preoperative patient data.

	NYHA I-II, N = 39	NYHA III-IV, N = 47	P value
Age, years	55.9 (8.3), 42-69	58.5 (7.3), 48.0-71	0.123
Sex (Male)	21	28	0.664
HD vintage, months	66.2 (15.6), 44-91	62.6 (14.6), 42.0-88	0.268
NYHA			
I	4		NA
II	35		
III		46	
IV		1	
Qa, l/min	2.7 (0.39), 1.8-3.5	2.8 (0.42), 1.4-3.9	0.244
CO, l/min	8.3 (1), 5.6-10.3	8.1 (1.3), 4.5-10.9	0.458
CI, l/min/m^2	4.2 (0.5), 3.2-5.3	4.2 (0.6), 2.7-5.4	0.808
CFR, %	32.4 (3.1), 27.5-38.8	34.6 (5), 27.1-44	**0.012**
EF, %	58.5 (7.5), 46-70	57.6 (7.4), 46-71	0.585
EDV index, ml/min/m^2	87.6 (14.2), 60.8-114.8	91.5 (14), 63.0-116.1	0.196
LV mass index, g/m^2	122.1 (11.4), 89.6-142.3	128.3 (15), 98.9-175.7	0.034
PASP, mmHg	41 (6.9), 27-55	48.4 (6.7), 33-58	**<0.001**
NT-proBNP, ng/l	4433 (2119), 2249-12254	5891 (2684), 2107-13482	**0.006**

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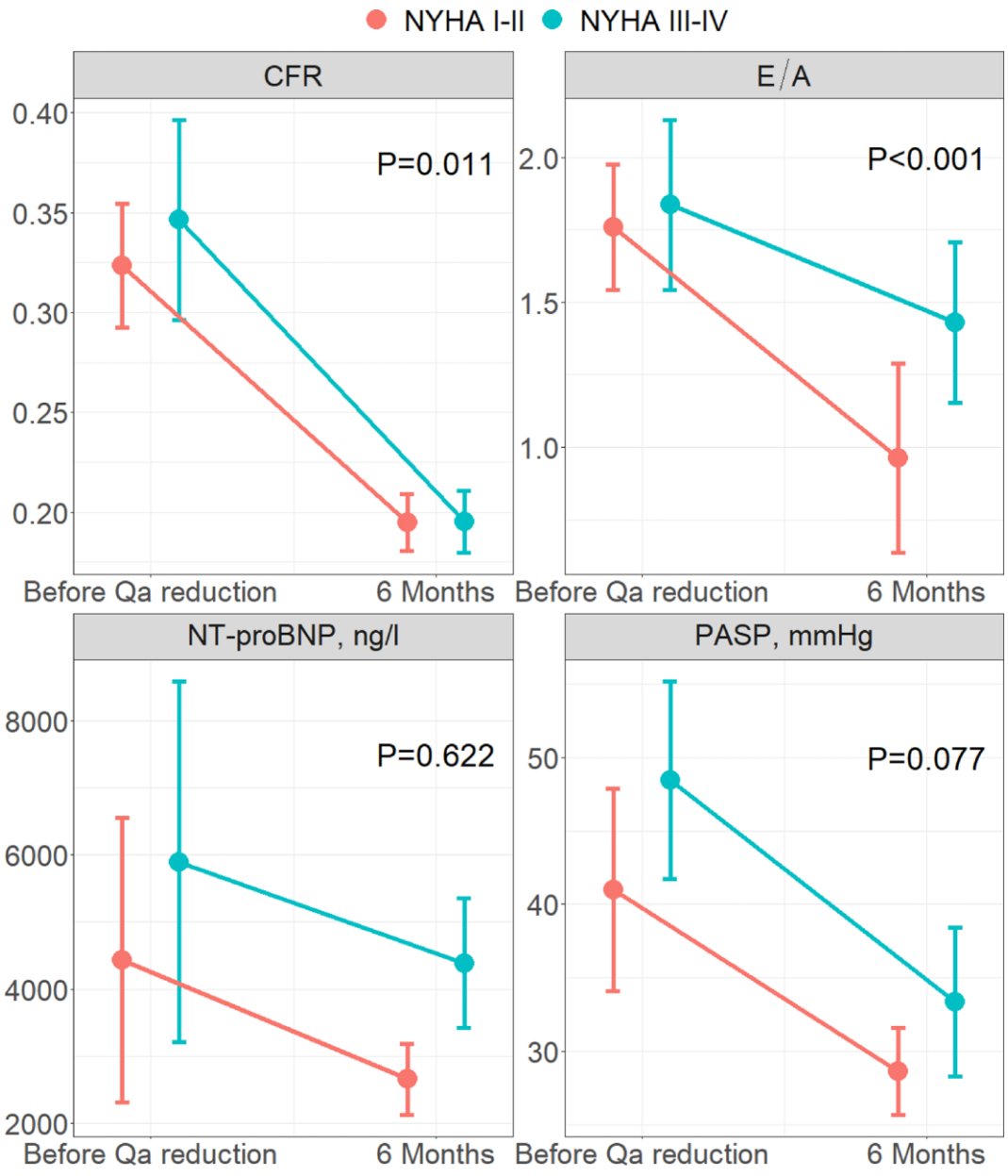

Figure 1: The results of Qa reduction. Mean, SD and P-value for group*time interaction in the mixed-effects model are given.

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