Proportional pulse pressure, a new non-invasive parameter with prognostic value in advanced heart failure. Therapeutic implications

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Background
Recent studies showed that in advanced systolic heart failure (ASHF), despite the low systolic blood pressure (SBP) the low pulse pressure (PPP) is also an independent risk marker of mortality. Proportional pulse pressure (PPP) as ratio of PP and SBP ( PPP/SBP) showed closer correlation with cardiac index and stroke index compared to PP and its lower values proved to have high predictive accuracy for low cardiac output.

Aim
First: to investigate the prognostic value of proportional pulse pressure in patients with advanced heart failure.
Second: to investigate the prognostic value of the change of proportional pulse pressure during treatment optimization in patients with advanced heart failure.

Patients
- >169 consecutive patients (125 men) from our heart failure clinic admitted for advanced systolic heart failure
- NYHA functional class III/IV (mean: 3.35±0.45)
- Mean age: 62.2 years (range: 17–89)
- Ischemic origin: 63 patients (37%)
- Diabetic mellitus: 75 patients (40%)
- NYHA functional class at optimal treatment: HR: 1.05 (95% CI: 0.44–2.45, p=0.81)
- Age: every additional 1 year: HR: 1.05 (95% CI: 1.00–1.10), p=0.05
- Drugs with target doses or tolerated highest doses: 
  - Diuretics: 100% in lowest doses required to maintain optimal fluid balance
  - ACE: 5%
  - Beta-blocker: 91%
  - Aldosterone receptor antagonist: 76%
  - Dihydropyridine: 79%
  - Nitrate: 88%
  - Diuretics: 100% in lowest doses required to maintain optimal fluid balance
  - CRT-D or CRT-P: 21%
  - ICD: 8%

Methods I.
Assessment of the parameters of patients after admission
- Optimization of treatment (drugs and device)
- Reassessment of parameters after treatment optimization (3.4 months after the admission)
- Follow-up (mean: 38.8 months)

Results I.
Assessment of the predictive value of PPP
- Univariate Cox regression
  - PPP decreased vs. unchanged or increased: HR: 2.47 (95% CI: 0.91–6.94), p=0.08
  - Ischemic vs. Nonischemic: HR: 2.40 (95% CI: 1.24–4.66), p=0.01
  - Age 55 years vs. younger than 55 years: HR: 1.96 (95% CI: 1.00–3.89), p=0.05
  - Male vs. Female: HR: 1.96 (95% CI: 1.00–3.89), p=0.04
  - Diabetes mellitus: HR: 1.13 (95% CI: 0.56–2.25), p=0.74
  - NYHA functional class III/IV (mean: 3.35±0.45), p=0.42
  - LV ejection fraction: HR: 0.49 (95% CI: 0.25–0.96), p=0.03

Conclusions:
In advanced systolic heart failure treated optimally, proportional pulse pressure is a significant risk indicator, its higher values relate to a more favourable long-term outcome. When during treatment optimization PPP increases, we can count on a favourable long-term effect independently from changes in systolic blood pressure. Proportional pulse pressure involving both pulse pressure and systolic blood pressure (PP/SBP) is a simple parameter which can be used easily in daily clinical practice, follow-up of patients, and can help in the optimization of treatment.

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