

Post-processing measurement of left ventricular ejection fraction compared to direct measurement in patients with heart failure with reduced ejection fraction

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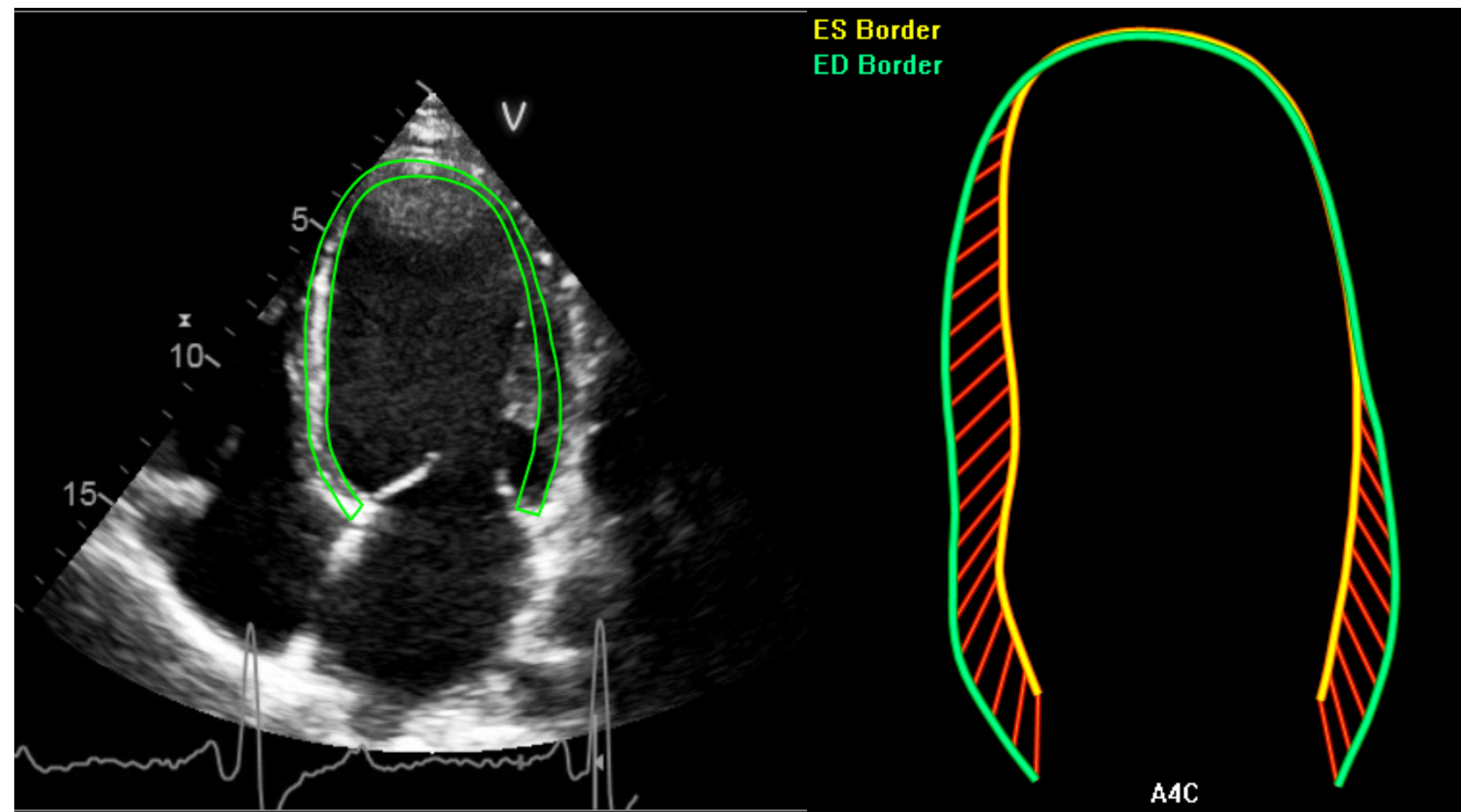
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Purpose

➤ *The study aims to:*
Compare different methods of LVEF quantification, using direct and image post-processing techniques, and their correlations to NT-proBNP plasma concentrations in patients with a previous diagnosis of HFrEF.

Methods

- A total of 205 clinically stable patients diagnosed with HFrEF were enrolled in a prospective cohort study.
- Patients underwent a standardized echocardiographic examination using a GE Vivid E9 ultrasound machine, performed by two investigators with the experience of more than 5.000 performed echocardiographic examinations.
- Biplane LVEF according to Simpson's method was evaluated directly during the examination.
- Post-processing evaluation of biplane and triplane LVEF (pp LVEF) using the vendor-independent software TomTec was performed by a blinded investigator who underwent comprehensive training in post-processing analysis.
- Post-processing analysis was feasible in 164 patients.
- For correlations analyses patients were subdivided according to the underlying etiology of HF into ischemic and non-ischemic HF.



Results

1 Positive correlations between different measurements of the left ventricular ejection fraction and NT-proBNP.

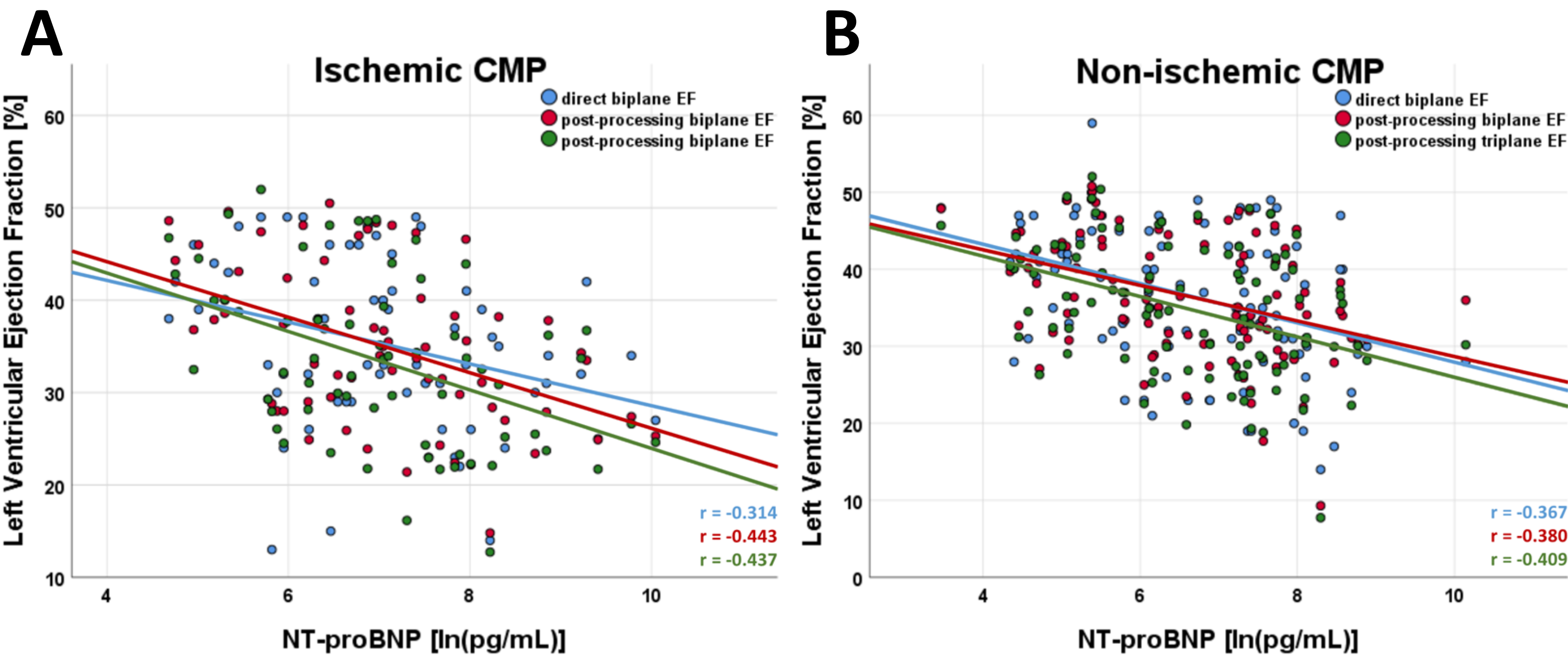


Fig. 1: Correlations between LVEF and NT-proBNP in patients with (A) ischemic and (B) non-ischemic origin of heart failure. The correlation between biplane LVEF and NT-proBNP was more pronounced in patients with ischemic HF (n=65) using post-processing than direct measurement (pp: $r = -0.443$, $p < 0.001$; direct: $r = -0.314$, $p = 0.01$). We did not observe such a signal in patients with non-ischemic HF (n=99) where both measurements showed comparable correlations to NT-proBNP.

2 Bland Altman plot reveals a high variability between direct and post-processing biplane LVEF values.

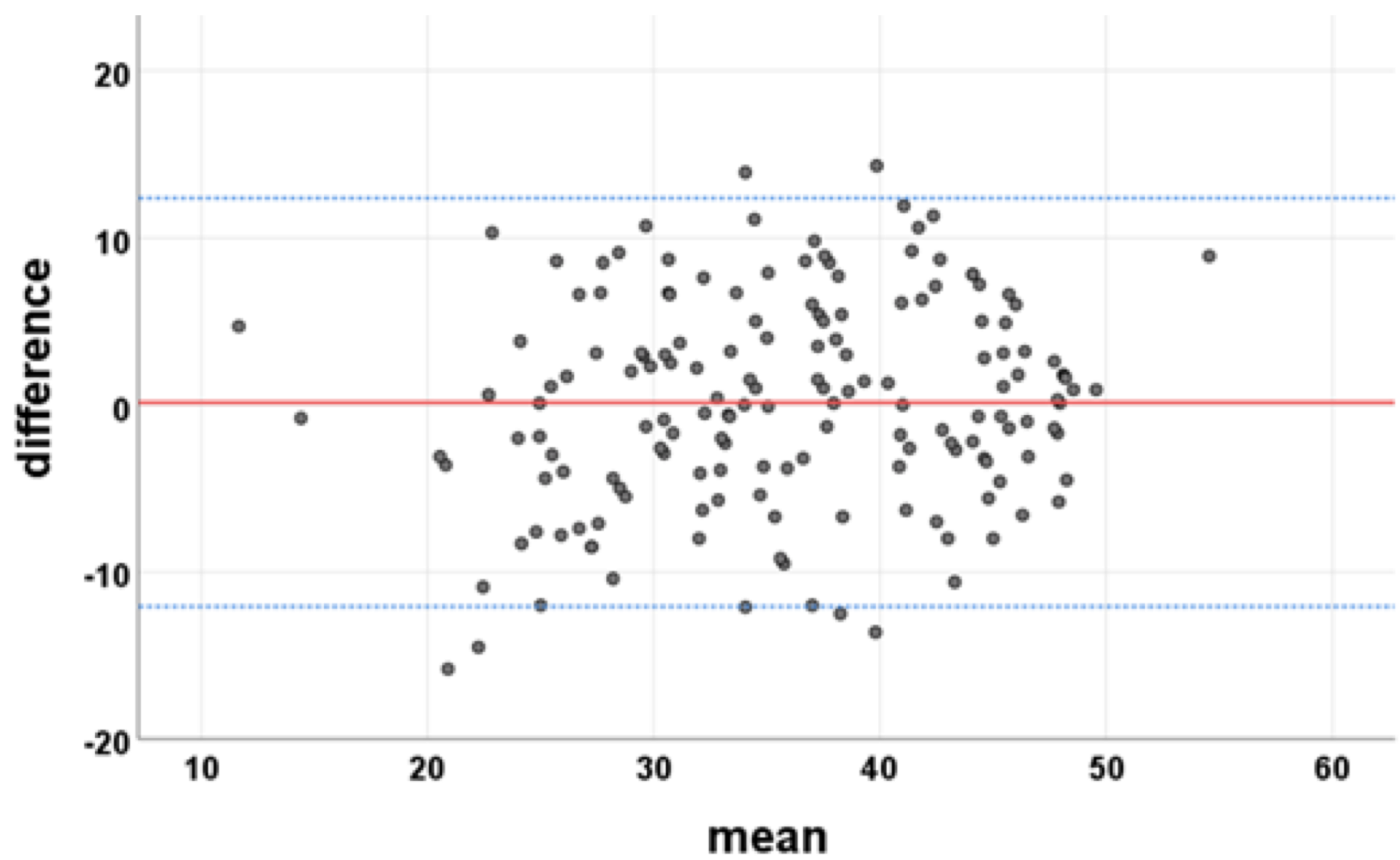


Fig. 2: Bland Altman plot revealed a high variability between direct and post-processing biplane LVEF values, with a mean difference of $0.15 \pm 6.2\%$. Linear regression analysis indicated proportional bias between both measurements across all LVEF ranges ($\beta = 0.154$, $p = 0.049$).

3 Application of post-processing analyses lead to a reclassification from LVEF >35% to LVEF ≤35% in one out of five patients.

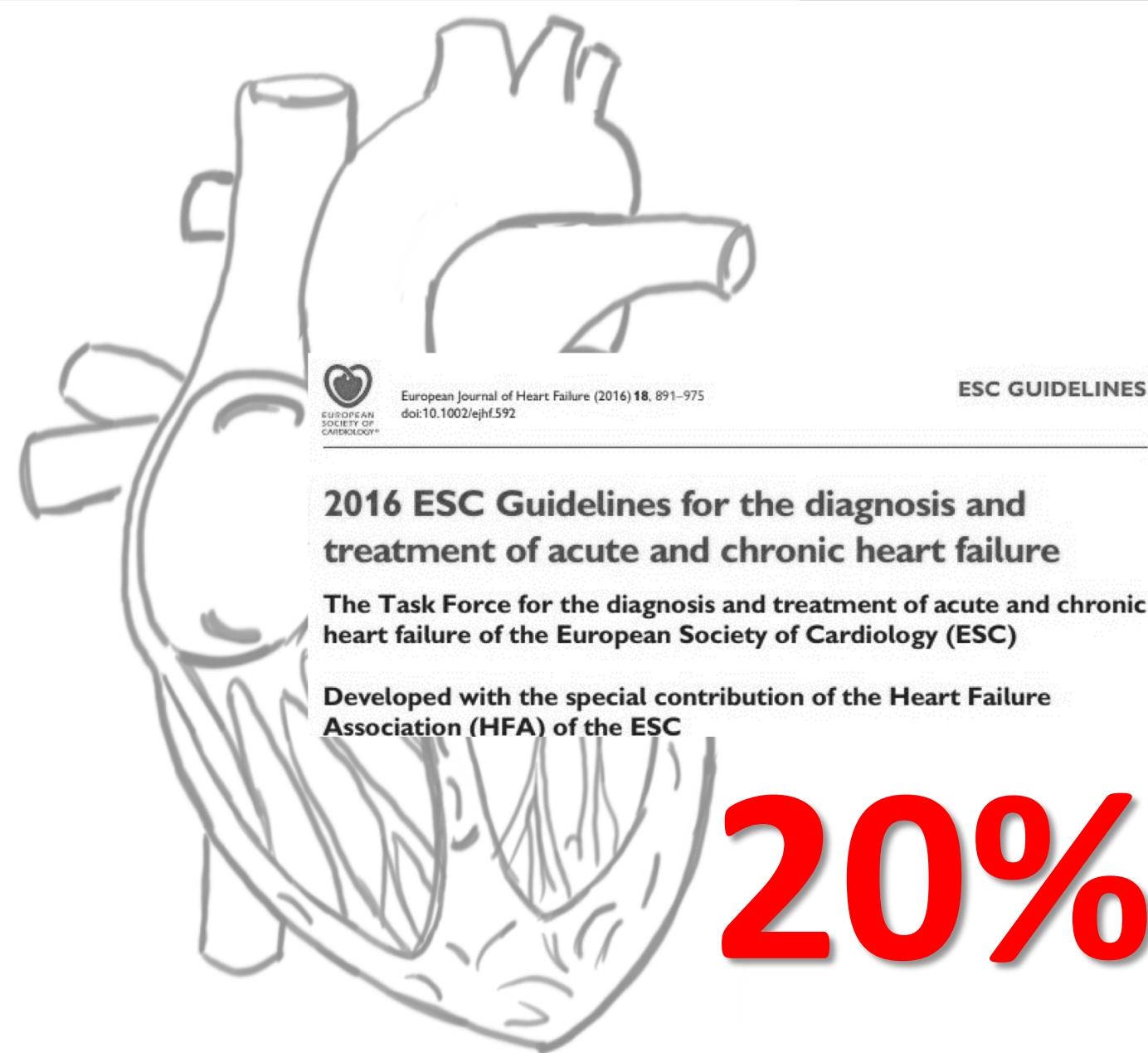


Fig. 3: Among 83 patients with direct biplane LVEF >35%, a total of 16 had a pp biplane LVEF ≤35% (mean pp biplane $43.3 \pm 4.5\%$ vs $32.0 \pm 2.3\%$, $p < 0.001$; median NT-proBNP 511 [IQR 179-1421] vs. 1205 [IQR 457-3706] pg/mL, $p = 0.055$). On the other hand, out of 81 patients with direct biplane LVEF ≤35%, 16 patients had pp biplane LVEF >35% (mean pp biplane $28.2 \pm 4.8\%$ vs $39.2 \pm 3.4\%$, $p < 0.001$; median NT-proBNP 1644 [IQR 711-3113] vs. 543 [IQR 297-3015] pg/mL, $p = 0.1$).

Conclusion

Direct biplane LVEF measurement shows low agreement with post-processing biplane LVEF in patients with HFrEF. Post-processing biplane LVEF analysis appears to provide more accurate values and should be preferred in examinations with therapeutic implication, particularly in patients with HFrEF of ischemic origin.