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Hemolysis and Its Association with Major Bleeding and Thromboembolic Complications in Patients Receiving Temporary Mechanical Circulatory Support: A Retrospective Cohort Study

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KEYWORDS: cardiogenic shock, mechanical circulatory support, hemolysis.

CITATION: Cardiol Croat. 2026;21(11-12):343-4. | https://doi.org/10.15836/ccar2026.343

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Introduction: Temporary mechanical circulatory support (tMCS) can be a lifesaving intervention in patients with cardiogenic shock[1]. However, its use is associated with significant hemorrhagic and thrombotic complications. Device-related hemolysis may contribute to hemostatic disturbances and represent a potential marker of adverse events[2,3]. This study aimed to investigate the association between hemolysis and subsequent major bleeding and thrombotic complications in patients receiving tMCS.

Patients and Methods: We conducted a retrospective, single-center cohort study including 26 patients with cardiogenic shock treated with tMCS between December 2022 and September 2026. Support modalities included veno-arterial extracorporeal membrane oxygenation (VA-ECMO), Impella CP and 5.5

TABLE 1. Baseline characteristics.

Characteristic	Hemolysis (n = 14)	No hemolysis (n = 12)	p-value
Age, years	63 [58.5–65.5]	64 [58.3–68.8]	0.589
Male sex	11 (78.6%)	8 (66.7%)	0.665
Body mass index, kg/m²	26.9 [24.7–28.0]	25.7 [24.2–29.4]	0.978
Previous heart failure	2 (14.3%)	3 (25.0%)	0.635
Hypertension	11 (78.6%)	9 (75.0%)	1.000
Diabetes mellitus	1 (7.1%)	3 (25.0%)	0.306
Chronic kidney disease	1 (7.1%)	2 (16.7%)	0.580
SCAI stage	3 [3–3.75]	3 [2.75–3.25]	0.434
APACHE II score	11 [8.5–13.5]	10.5 [9–12.25]	0.938
SOFA score	5.5 [3–7.5]	3.5 [3–6]	0.319
AMI-related cardiogenic shock	8 (57.1%)	5 (41.7%)	0.695
Baseline lactate, mmol/L	7.70 [5.60–10.76]	3.49 [2.26–5.75]	0.061
Baseline hemoglobin, g/L	144.5 [127.5–153.8]	124.5 [118.3–135.0]	0.129
Baseline platelets, ×10⁹/L	259 [209–332.5]	217 [192–268.8]	0.625

Values are presented as median [interquartile range] or n (%). Categorical variables were compared using Fisher's exact test and continuous variables using the Mann–Whitney U test.

SCAI, Society for Cardiovascular Angiography and Interventions; APACHE II, Acute Physiology and Chronic Health Evaluation II; SOFA, Sequential Organ Failure Assessment; AMI, Acute myocardial infarction.

RECEIVED: October 25, 2026
UPDATED: November 4, 2026

(Abiomed, Danvers, MA, USA), intra-aortic balloon pump (IABP), and combined support strategies. Hemolysis was defined by laboratory evidence. The primary outcomes were major bleeding, defined as Bleeding Academic Research Consortium (BARC) type 3-5 and Extracorporeal Life Support Organization (ELSO) bleeding grade ≥1, and thrombotic complications. In-hospital mortality was assessed as a secondary outcome. Associations were assessed using Fisher's exact test, with odds ratios (ORs) and 95% confidence intervals (CIs).

Results: Among 26 patients, 14 (53.8%) developed laboratory evidence of hemolysis. Baseline characteristics (**Table 1**), including age, sex, comorbidities, and disease severity scores, did not differ significantly between patients with and without hemolysis. Baseline lactate was numerically higher in patients with hemolysis (7.70 vs. 3.49; p=0.061). Major bleeding occurred in 13 patients (50.0%), while thrombotic complications were documented in five (19.2%), with two patients experiencing both complications. Major bleeding was more frequent in patients with hemolysis (64.3% vs. 33.3%; OR 3.60, 95% CI 0.71–18.25; p=0.238). Similarly, thrombotic complications occurred more frequently in patients with hemolysis (28.6% vs. 8.3%; OR 4.40, 95% CI 0.42–46.26; p=0.330). The composite endpoint occurred in 78.6% versus 41.7%, respectively (OR 5.13; p=0.105) (**Figure 1**.). Hemolysis rates were 66.7% with VA-ECMO, 66.7% with Impella CP, and 75.0% with combined support, whereas none of the patients receiving IABP alone developed hemolysis. In-hospital mortality was numerically higher in patients with hemolysis than in those without hemolysis (50.0% vs. 33.3%; OR 2.00; p=0.453), although the difference was not statistically significant.

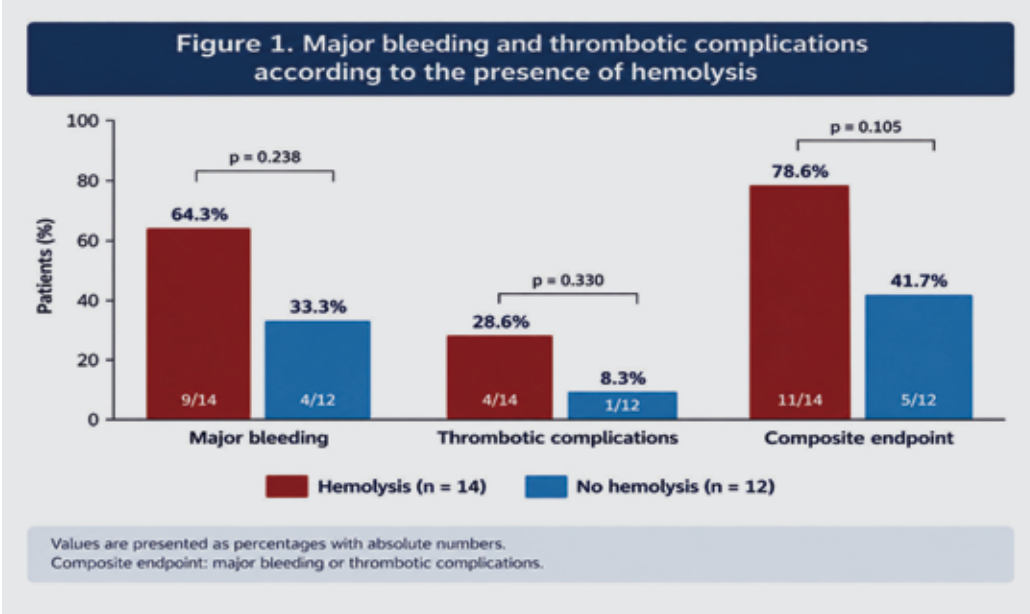

FIGURE 1. Major bleeding and thrombotic complications according to the presence of hemolysis.

Conclusion: Hemolysis was associated with numerically higher rates of major bleeding and thrombotic complications during tMCS, although these associations did not reach statistical significance. Larger prospective studies are warranted to clarify its prognostic significance and relationship with device-related complications.

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