diabetes, hypertension, obstructive sleep apnea, and other diseases that have considerable health impact. Although further studies are needed to fully substantiate generalizability of various scores into the preoperative evaluation, this study is compelling in bringing the conversation of nutrition into routine clinical practice. Although the limitations of this clinical study are obvious (eg, retrospective design, low statistical power, single center/unique geographic location), the results indicate that preoperative nutritional status may profoundly influence outcome in patients undergoing cardiac surgery and perhaps

should become part of routine preoperative risk stratification.

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Commentary: Nutritional status before cardiac surgery—at the 11th hour

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CENTRAL MESSAGE

Nutritional status before cardiac surgery significantly influences patient outcomes and survival.

Assessment of numerous preoperative factors, such as a patient's age, comorbidities, and nutritional status, are of high clinical relevance before surgery because they influence his or her mid- and long-term outcomes, especially after cardiac surgery.^{1,2} Malnutrition affects up to 46.4% of cardiac surgery patients³ and their nutritional status will worsen after surgery due to the commonly occurring perioperative inflammatory response and

frequently observed inadequate postoperative nutrition support.⁴ Conceptually, malnutrition can be divided into starvation independent from any disease (starvation-related) and disease-related malnutrition.⁵ Nutritional deficiencies may negatively influence the postoperative systemic inflammatory and catabolic response, further contributing to the development of organ dysfunctions in intensive care units (ICUs).^{1,2} Despite the growing evidence about the detrimental effects of chronic and acute malnutrition in high-risk cardiac surgery patients, no specific nutrition guidelines exist and nutrition screening is seldom implemented in clinical routine practice.⁶ Adequate nutritional risk assessment is crucial to identify patients at nutritional risk and/or with poor nutritional status before surgery to allow tailored initiation of optimization strategies. At the least, these should include early initiation

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FIGURE 1. The clinical significance of preoperative nutritional risk assessment and potential strategies to improve outcomes in cardiac surgery patients. The preoperative nutritional risk is crucial for cardiac surgery patients and thus underlines the promising role of preoperative optimization strategies to improve outcomes in patients undergoing cardiac surgery.

of adequate nutrition support after surgery to prevent further deterioration of nutritional status.¹ In this context, recent evidence indicates the combined use of European System for Cardiac Operative Risk Evaluation score, cardiopulmonary bypass time, and nutritional risk screening tools for prediction of prolonged ICU stay in patients undergoing cardiac surgery as a relevant method to identify cardiac surgery patients at high nutritional risk.⁷ The prediction of a prolonged ICU stay was demonstrated to identify patients at risk for underfeeding who may benefit from an early-initiated preoperative

optimization strategy and adequate postoperative nutrition support.⁷ The influence of patients' nutritional status was seen predominantly in patients undergoing valve surgery, indicating the relevance of the pathophysiology from the underlying disease. In fact, previous studies already demonstrated that malnutrition occurred more often in patients with valvular disease; this may result from the significant alterations in hemodynamic and inflammation observed in these patients.⁷

In this context, Cho and colleagues⁸ further confirm the clinical relevance of assessing nutritional status before

valvular cardiac surgery. In a single-center retrospective analysis, the investigators demonstrate that a patient's preoperative malnutrition as assessed by the Controlling Nutritional Status score is associated with higher mortality after valvular heart surgery and an independent predictor for mortality.⁸ The Controlling Nutritional Status score is calculated using serum albumin, total cholesterol level, and total lymphocyte count, classifying patients into normal, mild, moderate, and severe risk. Although this assessment does not adequately evaluate a patient's nutritional intake before surgery and may thus be of limited value because it does not adequately capture the major etiologies for malnutrition, it further underlines the clinical significance of adequate nutrition in these patients.

Although evidence from adequately designed randomized controlled trials in cardiac surgery is still rare,⁹ adequate nutritional risk assessments should be increasingly considered and implemented as part of the clinical routine to identify patients at nutritional risk in which preoperative optimization and pre-habilitation strategies before elective cardiac surgery may provide clinically meaningful effects.^{2,6} The preoperative phase from indication to surgery represents an attractive time window for an optimization therapy that should be a tailored combination of oral nutrition supplements, a high-calorie and high-protein diet to avoid fluid and salt overload, and substitution of vitamins and trace elements that ideally attenuate the systemic inflammatory and metabolic response after surgery.^{1,2} Significant benefits of such nutrition therapies have already been shown for malnourished patients undergoing surgery and the European Society of Parenteral and Enteral Nutrition accordingly recommends nutrition optimization strategies preoperatively for severely malnourished patients, even if this leads to a delay in elective surgery.¹⁰ For cardiac surgery patients, the Enhanced Recovery After Surgery initiative recommends a correction of nutritional deficiencies when feasible, although no adequately powered trials are yet available in these patients (Figure 1).¹¹ However, the time window for such treatment to become effective is often not available because cardiac

surgery patients are often admitted only 24 to 48 hours before surgery, which indicates the need to develop and validate alternative strategies for shorter time windows.

The detection of nutritional risk and diagnosis of malnutrition by valid, reliable, and responsive indicators needs more consideration in the perioperative care of patients undergoing cardiac surgery. Although tailored early postoperative nutrition treatment should be standard of care, effective short-term nutrition therapy is still lacking for the setting of cardiac surgery and further research is warranted.

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