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Editorial

Acute Heart Failure Risk Stratification in the Emergency Department: Are We There Yet?

Estratificación del riesgo en pacientes que acuden a urgencias con fallo cardiaco agudo: ¿estamos preparados?

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Imagine you are working in a busy emergency department (ED). You just finished caring for an elderly woman with acute heart failure (AHF). She feels better and requests to go home. Do you send her home? Do you admit her? What do you do?

AHF is a global public health burden.[1–3] In the United States, an estimated 5.7 million Americans have heart failure (HF), and 915 000 cases are newly diagnosed each year.[1] For patients older than 65 years, AHF is the most common reason for hospitalization and rehospitalization.[4] Nearly 80% of all patients who present to the ED with AHF will be hospitalized. Already, over 100 billion US dollars annually is consumed by the cost of HF worldwide.[5] As the population ages and patients live longer with cardiovascular disease, the burden of AHF will continue to grow.[6]

Why are so many patients hospitalized? Emergency physicians tend to be risk-averse and AHF patients have high rates of morbidity and mortality. Within 30 days postdischarge, nearly one-third of patients die or are rehospitalized.[7] Factors contributing to these high admission rates are older age, a high comorbid burden, and the absence of a past physician-patient relationship. Not knowing what is 'baseline' for a given patient; there is no way to compare a patient to his or her prior self. Does the patient look better, worse, or the same today as 30 days ago?

This highlights the need for risk stratification.[8] Risk stratification instruments for AHF have been developed in multiple countries.[9–17] These instruments attempt to discriminate low vs high risk, in an effort to determine which patients with AHF can be safely discharged early. However, their limitations significantly affect their feasibility and applicability in the ED setting. Thus, they have not been widely adopted. As a result, current medical decision-making regarding ED disposition is largely based on clinician gestalt, combined with the absence of higher risk features.

One risk-instrument of note is the brilliantly named MEESSI (Multiple Estimation of risk based on the Spanish Emergency Department Score in patients with AHF) score. The MEESSI score was developed to risk stratify AHF patients in Spanish EDs.[18] This score predicted 30-day mortality risk in hospitalized patients using 13 variables, demonstrating excellent discrimination (c-statistic 0.836) for the derivation cohort. These 13 variables included the Barthel index at admission, systolic blood pressure, respiratory rate, age, NT-proBNP level, potassium, troponin, creatinine, New York Heart Association (NYHA) functional class at admission, low output symptoms (ie, confusion, weakness, poor peripheral perfusion, oliguria), oxygen saturation, episodes associated with acute coronary syndrome, and ECG with hypertrophy.[18,19]

In an article recently published in *Revista Española de Cardiología*, Miró et al. set out to further validate their derived risk score. They conducted a prospective observational validation study,[19] enrolling 4711 consecutive patients with AHF from 30 Spanish EDs. Of note, they included hospitals not participating in the original derivation study. The only exclusion criterion consisted of patients with ST-segment elevation myocardial infarction. The MEESSI score risk stratified patients into low, intermediate, high, and very high risk. In this validation cohort, 10% of patients died within 30 days of ED admission, a mortality rate consistent with other 'real-world' analyses. When stratified by risk group, 30-day mortality was 2.0%, 7.8%, 17.9%, and 41.4%, respectively, from low, intermediate, high, and very high risk. The score demonstrated strong risk discrimination with a c-statistic of 0.810 (95% confidence interval, 0.790-0.830; $P < .001$). With these impressive results, we are left wondering whether the MEESSI score is ready for everyday use.

The large sample size, number of hospitals, and broad demographic characteristics support its generalizability, at least for Spanish EDs. Several baseline characteristics are worth highlighting, namely the high proportion of patients with preserved ejection fraction (HFpEF) as well as a first episode of AHF. Overall, hospitalized HFpEF patients have better outcomes. This is debated, however, with several studies showing no differences. However, in the study by Miró et al.,[19] the relatively low proportions of guideline-directed medical therapy suggest that this is due to the large number of HFpEF patients. Nevertheless, the guideline adherence rate was not mentioned stratified by ejection fraction. Thus, its potential impact on outcomes, despite robust adjustment, is uncertain. This adherence rate is probably also influenced by the $>$ 40% of patients with a first episode of AHF. Whether these are chronic HF patients with their first AHF episode or their very first diagnosis of HF is unknown. In the United States, de novo AHF patients–HF for the very first time–are generally recommended to

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be hospitalized.[20,21] Outside of the hospital, it is challenging to cover expeditiously comprehensive evaluation to determine the etiology of HF,[22] management of both the AHF episode and the current precipitant, as well as disease education for a potentially life-long chronic condition.

The score itself involves 13 variables to calculate, with an online risk-calculator for ease of use.[23] However, the Barthel index involves an additional 10 questions[24] that are not routinely asked during a patient visit. The additional time taken to obtain these data may be a significant barrier to use. Additionally, 3 variables–the Barthel index, NYHA functional class, and low cardiac output–are partially based on subjective interpretation and may lead to variability when calculating a score.

Another question involves determining an acceptable threshold for mortality. Patients in the low-risk group had a high number of adverse events, including 2% mortality, 18% ED revisits, and 11% rehospitalization at 30-days. A mortality rate of 2% is relatively high, despite being an acceptable number based on expert consensus recommendation,[25] and may deter clinicians from discharging patients directly from the ED.

The single greatest confounder for the MEESSI risk score, similar to other AHF risk-scores, is the impact of hospitalization. This has plagued risk score development, as high admission rates are common. The authors acknowledge this very point, as nearly 75% of patients were hospitalized. Management during hospitalization itself may significantly alter the outcome, and thus the risk trajectory of patients. Until a validation study is performed in which patients are sent home based on MEESSI scores and event rates captured, we will not truly know whether there is sufficient discrimination to use the score in everyday practice.

Overall, the MEESSI score is a major step in the right direction for risk stratifying AHF patients in the ED. The authors are to be congratulated for a well-designed, large, multicenter study addressing a major unmet need in ED AHF management: identifying lower-risk patients safe for discharge. This work helps bridge this knowledge gap. While we are getting closer, we are not there yet.

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CONFLICTS OF INTEREST

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REFERENCES

1. Mozaffarian D. Benjamin E. Go A. et al. American Heart Association Statistics Committee; Stroke Statistics Subcommittee. Heart Disease and Stroke Statistics-2016 Update: A Report From the American Heart Association. *Circulation.* 2016;133:e38–e360.
2. Adams Jr KF, Fonarow G. Emerman C. et al. ADHERE Scientific Advisory Committee and Investigators. Characteristics and outcomes of patients hospitalized for heart failure in the United States: Rationale, design, and preliminary observations from the first 100,000 cases in the Acute Decompensated Heart Failure National Registry (ADHERE). *Am Heart J.* 2005;149:209–216.
3. Yancy C. Jessup M. Bozkurt B. et al. American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. 2013 ACCF/AHA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation.* 2013;128:e240–e327.
4. Jencks S. Williams M. Coleman E. Coleman. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med.* 2009;360:1418–1428.
5. Cook C. Cole G. Asaria P. Jabbour R. Francis D. The annual global economic burden of heart failure. *Int J Cardiol.* 2014;171:368–376.
6. Benjamin E. Virani S. Callaway C. et al. American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart Disease and Stroke Statistics-2018 Update: A Report From the American Heart Association. *Circulation.* 2018;137:e67–e492.
7. Dharmarajan K. Wang Y. Lin Z. et al. Association of Changing Hospital Readmission Rates With Mortality Rates After Hospital Discharge. *JAMA.* 2017;318:270–278.
8. Pang P. Collins S. Acute Heart Failure in the Emergency Department: Just a One Night Stand? *Acad Emerg Med.* 2017;24:385–387.
9. Stiell I. Perry J. et al. Prospective and Explicit Clinical Validation of the Ottawa Heart Failure Risk Scale, With and Without Use of Quantitative NT-proBNP. *Acad Emerg Med.* 2017;24:316–327.
10. Fonarow G. Clinical risk prediction tools in patients hospitalized with heart failure. *Rev Cardiovasc Med.* 2012;13:e14–e23.
11. Lee D. Ezekowitz J. Risk stratification in acute heart failure. *Can J Cardiol.* 2014;30:312–319.
12. Lee D. Austin P. Rouleau J. Liu P. Naimark D. Tu J. Predicting mortality among patients hospitalized for heart failure: derivation and validation of a clinical model. *JAMA.* 2003;290:2581–2587.
13. Auble T. Hsieh M. Gardner W. et al. A prediction rule to identify low-risk patients with heart failure. *Acad Emerg Med.* 2005;12:514–521.
14. Collins S. Jenkins C. Harrell Jr FE et al. Identification of emergency department patients with acute heart failure at low risk for 30-day adverse events: The STRATIFY decision tool. *JACC Heart Fail.* 2015;3:737–747.
15. Hsieh M. Auble T. Yealy and DM. Validation of the Acute Heart Failure Index. *Ann Emerg Med.* 2008;51:37–44.
16. Peterson P. Rumsfeld J. Liang L. et al. American Heart Association Get With the Guidelines-Heart Failure Program. A validated risk score for in-hospital mortality in patients with heart failure from the American Heart Association get with the guidelines program. *Circ Cardiovasc Qual Outcomes.* 2010;3:25–32.
17. Lee D. Stitt A. Austin P. et al. Prediction of heart failure mortality in emergent care: a cohort study. *Ann Intern Med.* 2012;156:767–775W-261, W-262.
18. Miró Ó. Rossello X. Gil V. et al. ICA-SEMES Research Group. Predicting 30-day mortality for patients with acute heart failure who are in the emergency department: a cohort study. *Ann Intern Med.* 2017;167:698–705.
19. Miró Ò. Rosselló X. Gil V. et al. The Usefulness of the MEESSI Score for Risk Stratification of Patients With Acute Heart Failure at the Emergency Department. *Rev Esp Cardiol.* 2018. http://dx.doi.org/10.1016/j.rec.2018.05.002.
20. Hunter B. Martindale J. Abdel-Hafez O. Pang P. Approach to Acute Heart Failure in the Emergency Department. *Prog Cardiovasc Dis.* 2017;60:178–186.
21. Pang P. Collins S. Gheorghiade M. Butler J. Acute Dyspnea and Decompensated Heart Failure. *Cardiol Clin.* 2018;36:63–72.
22. Pang P. Komajda M. Gheorghiade M. The current and future management of acute heart failure syndromes. *Eur Heart J.* 2010;31:784–793.
23. Sociedad Española de Medicina de Urgencias y Emergencias. MEESSI-AHF Risk Model Calculator. Available from: http://meessi-ahf.risk.score-calculator-ica-semes.portalsemes.org/calc.html. Cited 26 Aug 2018.
24. Mahoney F. Barthel D. Functional evaluation: the Barthel index. *Md State Med J.* 1965;14:61–65.
25. Miró Ò. Levy P. Möckel M. et al. Disposition of emergency department patients diagnosed with acute heart failure: an international emergency medicine perspective. *Eur J Emerg Med.* 2017;24:2–12.