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## Postdischarge Assessment After a Heart Failure Hospitalization The Next Step Forward

Marco Metra, MD; Mihai Gheorghiade, MD; Robert O. Bonow, MD; Livio Dei Cas, MD

Heart failure (HF) is the most frequent cause of hospitalization for patients >65 years of age.<sup>1-5</sup> More than 1 million patients are admitted to the hospital with HF each year in the United States, and this number is likely to increase because of aging of the general population, improved survival after acute cardiovascular conditions, and prevention of sudden cardiac death. Hospitalization for HF is one of the most powerful independent risk factors for death among patients with HF. Mortality during the initial hospitalization ranges from 6% to 7% in Europe to 3% to 4% in the United States, depending on the length of hospital stay.<sup>1,2</sup> Poor outcomes have universally been shown after discharge, with 60- to 90-day mortality rates of 5% to 15% and hospital readmission rates of 30%.<sup>1,6,7</sup> Depending on the duration of the first hospitalization and on the number of previous hospitalizations, the risk of dying after a hospitalization for HF is increased from 4-fold to 16-fold compared with before the hospitalization.<sup>8</sup>

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Whereas the prognosis of patients with chronic HF has improved in recent years, there has been no change in the high risk of death or rehospitalization after an HF hospitalization.<sup>6,9-11</sup> This has multiple causes. First, the hospitalization for HF may be the expression of end-stage HF. In these patients, all therapies have already been tried and have become ineffective or were not tolerated. There are no chances to improve their symptoms and prognosis except with the use of assist devices or heart transplantation. These patients, however, are only a small proportion, <5%, of all the patients hospitalized for HF. An improvement in outcomes is possible in the others.<sup>1,12</sup> In addition to the lack of new therapies, incomplete relief from fluid overload, insufficient patient education, lack of implementation of evidence-based therapies, and poor postdischarge follow-up planning are among the main causes of their poor outcomes.<sup>2-4</sup>

The transition from the in-hospital to the outpatient setting involves not only changes in the physician(s) providing care

but also modifications in diet, self-dependence in the administration of new and complex drug therapies, demands for more physical activity, and confrontation with familial and social stresses. All of these factors make the early postdischarge period a vulnerable phase. Changes in fluid status and/or renal function frequently occur, and outcomes may be deeply affected.<sup>5,13</sup> In addition, up-titration of lifesaving therapies such as neurohormonal antagonists may require many weeks, and thus only an early postdischarge follow-up may allow its completion. Postdischarge assessment is now deemed an essential component of the treatment of the patients hospitalized for HF.<sup>2-4</sup> It directly follows the 3 earlier phases of evaluation and management of the patients with acute HF, summarized as the early or emergency department (ED) phase, the in-hospital phase, and the pre-discharge phase.<sup>2,7,13</sup> However, it remains to be established who should perform the postdischarge assessment, in which patients and when it should take place, and what should be its components.<sup>2-4</sup>

In this issue of *Circulation*, Lee et al<sup>14</sup> relate the type of transition care with the outcomes of 10 599 patients with HF evaluated at EDs in Ontario, Canada, between April 1, 2004, and March 31, 2007. Data obtained with the National Ambulatory Care Reporting System clearly demonstrate the benefits of a postdischarge assessment performed by both the primary care (PC) physician and the cardiologist compared with the lack of any physician assessment but also with PC-only practice.

### Who Should Perform Postdischarge Assessment?

The study by Lee et al provides answers to this question. Lee et al subdivided patients into 4 groups according to their postdischarge care: no physician visit (n=1990), PC only (n=6596), cardiologist only (n=535), and collaborative care including a PC physician and a cardiologist (n=1478). Internal medicine specialists who provided cardiology care were considered cardiac specialists. Compared with PC, collaborative care patients were more likely to undergo an assessment of left ventricular function (57.4% versus 28.7%), noninvasive stress testing (20.1% versus 7.8%), and cardiac catheterization (11.6% versus 2.7%). They were also more likely to be treated with angiotensin-converting enzyme inhibitors (58.8% versus 54.6%), angiotensin receptor blockers (22.7% versus 18.1%),  $\beta$ -blockers (63.4% versus 48.0%), spironolactone (19.8% versus 12.7%), and loop diuretics. In a propensity-matched model, PC was associated with significantly lower mortality compared with no physician evalua-

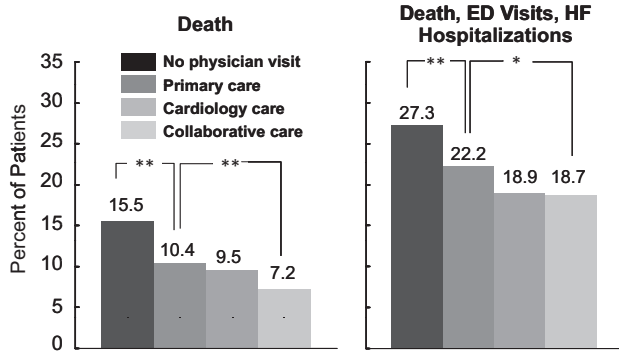
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**Figure.** Mortality rates (left) and rates of deaths, ED visits, and hospitalizations for HF (right) in the patients with different post-discharge follow-up. Collaborative care indicates care by both a PC physician and a cardiologist. \* $P=0.004$ ; \*\* $P<0.001$ .

tion ( $P<0.001$ ), thus showing the benefits of postdischarge follow-up. Collaborative care further reduced mortality compared with PC ( $P<0.001$ ). Similar results were found for the composite end points of death, ED visits, and HF rehospitalization (the Figure), as well as for all-cause ED visits, rehospitalizations, and deaths.<sup>14</sup>

Lee et al are to be commended for their comprehensive evaluation of such a complex reality as post-ED care follow-up. Their study shows the need and benefits of a collaborative approach including both the PC physician and the cardiologist after an ED admission for acute HF with a magnitude of effect that is comparable to that shown with neurohormonal antagonists or devices prescribed to treat HF. The present study also explores the potential mechanisms of this beneficial effect, including greater performance of diagnostic tests and implementation of lifesaving therapies. These data are consistent with previous studies comparing the treatment of patients with HF by PC physicians, internists, and cardiologists during either the in-hospital or the outpatient phase<sup>2,3,15</sup> and extend them to the early post-hospitalization phase, showing also the importance of this follow-up.

A potential limitation of the present study is the exclusion of early postdischarge events in order to have a comparison group of patients assessed by the PC physician. In another study from the same authors, ED visits for HF were followed by a high early mortality rate, with 4.0% of patients dying within 30 days and 1.3% in the first 7 days.<sup>16</sup> In addition, ED visits, but not hospitalizations, were analyzed in this study. This is pertinent because >30% of patients who underwent ED evaluation for HF were discharged without hospital admission in a similar cohort of patients.<sup>16</sup> The present study may lack data regarding clinical characteristics, comorbidities, and in-hospital course of the patients, so meaningful variables may not have been included in the propensity analysis. These limitations are acknowledged by the authors and are expected in studies based on the examination of large registries.

Despite its rationale, postdischarge assessment has been examined only recently.<sup>5,7</sup> Hernandez et al<sup>17</sup> have recently assessed the relationship between early physician follow-up and 30-day outcomes among 30 136 Medicare beneficiaries hospitalized for HF. Consistent with the study of Lee et al,

**Table.** Components of Early Postdischarge Follow-Up

Action	Expected Outcomes		
	Prevention of Fluid Overload	Improvement in Symptoms	Improvement in Prognosis
<b>Education</b>			
Diet	++	++	+
Exercise		++	+
Medications (benefits, side effects)	+	++	++
Weight monitoring	++	+	+
Detection and treatment of worsening symptoms	++	+	+
<b>Assessment of compliance</b>			
Medical therapy	++	+	++
Nonpharmacological prescriptions (diet, exercise, weight monitoring)	++	++	+
<b>Assessment of prognostic variables</b>			
<b>Clinical</b>			
Signs of congestion: pulmonary rales, jugular venous congestion, hepatomegaly, peripheral edema	+++	+	++
Blood pressure	+	?	+
Heart rate	?	+(?)	+
Orthostatic test	+	?	?
Valsalva maneuver	+	?	?
<b>ECG</b>			
QRS duration, indication to CRT	+	++	+++
Atrial fibrillation, tachyarrhythmias	+(?)	+	++
<b>Laboratory examinations</b>			
Myocardial viability*	+	+	++(?)
Natriuretic peptides	++	+	+
Renal function and electrolytes	+	+/0	+ / ++ (?)
Anemia and/or iron deficiency	?	++	?
Devices for fluid status monitoring	+++	+	+(+++)
<b>Optimization of medical treatment</b>			
Changes in diuretic doses according to fluid status	+++	+	+(?)
Initiation or uptitration of evidence-based therapies (renin-angiotensin-aldosterone antagonists, $\beta$ -blockers, digoxin)	+	+	+++
CRT when indicated	+	++	+++
ICD when indicated	0	0	+++
Coronary revascularization when indicated	+	+	+(?)
Other surgical procedures (eg, mitral valve surgery)	+	+	?

CRT indicates cardiac resynchronization therapy; ICD, implantable cardioverter defibrillator.

\*Viable but dysfunctional and potentially salvageable myocardium.

discharge from hospitals in which a greater proportion of patients received early follow-up evaluation was independently associated with lower rates of all-cause readmissions, although mortality was not affected.<sup>17</sup>

### When Should the Postdischarge Assessment Be Performed?

As outlined above, the vulnerable phase occurs just after discharge from hospital. The incidence of death or rehospitalizations sharply increases early after discharge and gradually decreases thereafter, following an almost exponential pattern.<sup>8,18</sup> This suggests that an early assessment, ie, 1 to 2 weeks after discharge, should yield the greatest benefit.

### Which Patients?

The number of patients hospitalized for HF is so large that a postdischarge assessment strategy cannot be proposed for all. Ideally, postdischarge assessment should include only the patients who, in the pre-discharge phase, are found to be at high risk of cardiac events. Simple but powerful predictors of postdischarge events include blood pressure, QRS duration, renal dysfunction, serum levels of sodium, natriuretic peptides and troponin, and other comorbidities.<sup>1,5,19</sup> The hospital length of stay and the number of previous rehospitalizations are also major prognostic variables.<sup>8,9,18</sup>

### What Should the Postdischarge Assessment Accomplish?

The postdischarge evaluation provides the opportunity to reassess fluid status, to provide additional patient education, to review medications and adjust their doses, and to plan for additional diagnostic and interventional procedures. Goals may target multiple mechanisms of HF, ranging from the prevention and treatment of congestion, and hence rehospitalization, to the improvement in symptoms and skeletal muscle function to beneficial cardiac remodeling, improvement in cardiac function, and enhanced prognosis.<sup>7</sup>

The study by Lee et al<sup>14</sup> suggests that the implementation of diagnostic examinations and evidence-based therapies by the PC physician and the cardiologist may favorably affect outcomes.<sup>1,5,7,18</sup> The importance of the components of the post-discharge assessment, suggested in the Table, will have to be examined by future studies, since they have not been tested in the post-discharge phase. Their application in clinical practice may successfully turn the hospitalization for HF from an ominous event heralding a poor prognosis to an opportunity to improve patient outcomes through education, correction of pathogenetic mechanisms and implementation of evidence based therapies.

### Disclosures

Dr Metra has received honoraria for participating in steering committees and advisory boards and giving speeches from Cardiokine, Corthera, Merck, and Servier. Dr Gheorghide has served as a consultant for Abbott Laboratories, Astellas, AstraZeneca, Bayer Schering Pharma AG, CorThera, Cytokinetics, DebioPharm S.A., Errekappa Terapeutici, GlaxoSmithKline, Icaria, Johnson & Johnson, Medtronic, Merck, Novartis Pharma AG, Otsuka Pharmaceuticals, Palatin Technologies, Pericor Therapeutics, Protein Design Laboratories, Sanofi-Aventis, Sigma Tau, Solvay Pharmaceuticals,

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### References

- Gheorghide M, Pang PS. Acute heart failure syndromes. *J Am Coll Cardiol*. 2009;53:557–573.
- Dickstein K, Cohen-Solal A, Filippatos G, McMurray JJ, Ponikowski P, Poole-Wilson PA, Strömberg A, van Veldhuisen DJ, Atar D, Hoes AW, Keren A, Mebazaa A, Nieminen M, Piorri SG, Swedberg K, Vahanian A, Camm J, De Caterina R, Dean V, Dickstein K, Filippatos G, Funck-Brentano C, Hellems I, Kristensen SD, McGregor K, Sechtem U, Silber S, Tendera M, Widimsky P, Zamorano JL, Tendera M, Auricchio A, Bax J, Böhm M, Corrà U, della Bella P, Elliott PM, Follath F, Gheorghide M, Hasin Y, Hemborg A, Jaarsma T, Komajda M, Kornowski R, Piepoli M, Prendergast B, Tavazzi L, Vachieri JL, Verheugt FW, Zamorano JL, Zannad F. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2008: the Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2008 of the European Society of Cardiology: developed in collaboration with the Heart Failure Association of the ESC (HFA) and endorsed by the European Society of Intensive Care Medicine (ESICM). *Eur J Heart Fail*. 2008;10:933–989.
- Jessup M, Abraham WT, Casey DE, Feldman AM, Francis GS, Ganiats TG, Konstam MA, Mancini DM, Rahko PS, Silver MA, Stevenson LW, Yancy CW. 2009 Focused update: ACCF/AHA guidelines for the diagnosis and management of heart failure in adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the International Society for Heart and Lung Transplantation. *Circulation*. 2009;119:1977–2016.
- Lindenfeld J, Albert NM, Boehmer JP, Collins SP, Ezekowitz JA, Givertz MM, Katz SD, Klapholz M, Moser DK, Rogers JG, Starling RC, Stevenson WG, Tang WH, Teerlink JR, Walsh MN. HFSA 2010 comprehensive heart failure practice guideline. *J Card Fail*. 2010;16:475–539.
- Gheorghide M, Bonow RO. Heart failure: early follow-up after hospitalization for heart failure. *Nat Rev Cardiol*. 2010;7:422–424.
- Ross JS, Chen J, Lin Z, Bueno H, Curtis JP, Keenan PS, Normand SL, Schreiner G, Spertus JA, Vidán MT, Wang Y, Wang Y, Krumholz HM. Recent national trends in readmission rates after heart failure hospitalization. *Circ Heart Fail*. 2010;3:97–103.
- Pang PS, Komajda M, Gheorghide M. The current and future management of acute heart failure syndromes. *Eur Heart J*. 2010;31:784–793.
- Solomon SD, Dobson J, Pocock S, Skali H, McMurray JJ, Granger CB, Yusuf S, Swedberg K, Young JB, Michelson EL, Pfeffer MA; Candesartan in Heart Failure: Assessment of Reduction in Mortality and Morbidity (CHARM) Investigators. Influence of nonfatal hospitalization for heart failure on subsequent mortality in patients with chronic heart failure. *Circulation*. 2007;116:1482–1487.
- Curtis LH, Greiner MA, Hammill BG, Kramer JM, Whellan DJ, Schulman KA, Hernandez AF. Early and long-term outcomes of heart failure in elderly persons, 2001–2005. *Arch Intern Med*. 2008;168:2481–2488.
- Bernheim SM, Grady JN, Lin Z, Wang Y, Wang Y, Savage SV, Bhat KR, Ross JS, Desai MM, Merrill AR, Han LF, Rapp MT, Drye EE, Normand SL, Krumholz HM. National patterns of risk-standardized mortality and readmission for acute myocardial infarction and heart failure: update on publicly reported outcomes measures based on the 2010 release. *Circ Cardiovasc Qual Outcomes*. 2010;3:459–467.
- Heidenreich PA, Sahay A, Kapoor JR, Pham MX, Massie B. Divergent trends in survival and readmission following a hospitalization for heart failure in the Veterans Affairs health care system 2002 to 2006. *J Am Coll Cardiol*. 2010;56:362–368.
- Metra M, Ponikowski P, Dickstein K, McMurray JJ, Gavazzi A, Bergh CH, Fraser AG, Jaarsma T, Pitsis A, Mohacs P, Böhm M, Anker S, Dargie H, Brutsaert D, Komajda M; Heart Failure Association of the European Society of Cardiology. Advanced chronic heart failure: a position statement from the Study Group on Advanced Heart Failure of the Heart Failure Association of the European Society of Cardiology. *Eur J Heart Fail*. 2007;9:684–694.

13. Blair JE, Khan S, Konstam MA, Swedberg K, Zannad F, Burnett JC Jr, Grinfeld L, Maggioni AP, Udelson JE, Zimmer CA, Ouyang J, Chen CF, Gheorghide M; EVEREST Investigators. Weight changes after hospitalization for worsening heart failure and subsequent re-hospitalization and mortality in the EVEREST trial. *Eur Heart J*. 2009;30:1666–1673.
14. Lee DS, Stukel TA, Austin PC, Alter DA, Schull MJ, You JJ, Chong A, Henry D, Tu JV. Improved outcomes with early collaborative care of ambulatory heart failure patients discharged from the emergency department. *Circulation*. 2010;122:1806–1814.
15. Jong P, Gong Y, Liu PP, Austin PC, Lee DS, Tu JV. Care and outcomes of patients newly hospitalized for heart failure in the community treated by cardiologists compared with other specialists. *Circulation*. 2003;108:184–191.
16. Lee DS, Schull MJ, Alter DA, Austin PC, Laupacis A, Chong A, Tu JV, Stukel TA. Early deaths in patients with heart failure discharged from the emergency department: a population-based analysis. *Circ Heart Fail*. 2010;3:228–235.
17. Hernandez AF, Greiner MA, Fonarow GC, Hammill BG, Heidenreich PA, Yancy CW, Peterson ED, Curtis LH. Relationship between early physician follow-up and 30-day readmission among Medicare beneficiaries hospitalized for heart failure. *JAMA*. 2010;303:1716–1722.
18. Setoguchi S, Stevenson LW, Schneeweiss S. Repeated hospitalizations predict mortality in the community population with heart failure. *Am Heart J*. 2007;154:260–266.
19. Metra M, Felker GM, Zacà V, Bugatti S, Lombardi C, Bettari L, Voors AA, Gheorghide M, Dei Cas L. Acute heart failure: multiple clinical profiles and mechanisms require tailored therapy [published online ahead of print May 25, 2010]. *Int J Cardiol*. doi: 10.1016/j.ijcard.2010.04.003.
20. Gheorghide M, Follath F, Ponikowski P, Barsuk JH, Blair JE, Cleland JG, Dickstein K, Drazner MH, Fonarow GC, Jaarsma T, Jondeau G, Sendon JL, Mebazaa A, Metra M, Nieminen M, Pang PS, Seferovic P, Stevenson LW, van Veldhuisen DJ, Zannad F, Anker SD, Rhodes A, McMurray JJ, Filippatos G. Assessing and grading congestion in acute heart failure: a scientific statement from the Acute Heart Failure Committee of the heart Failure Association of the European SOCIETY of cardiology and endorsed by the European Society of Intensive Care Medicine. *Eur J Heart Fail*. 2010;12:423–433.

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