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MINI-FOCUS ISSUE: PREVENTING HEART FAILURE ADMISSIONS

Intravenous Diuretic Therapy for the Management of Heart Failure and Volume Overload in a Multidisciplinary Outpatient Unit

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ABSTRACT

OBJECTIVES This study sought to evaluate the effectiveness of intravenous (IV) diuretic treatment for volume management in heart failure (HF).

BACKGROUND Limited data exist regarding IV diuretics for the outpatient treatment of volume overload in HF patients.

METHODS We analyzed 60 consecutive patients with chronic HF and clinical evidence of worsening congestion who received a bolus and 3-h IV infusion of furosemide at an outpatient HF clinic. Diuretic dosing was derived from the maintenance oral loop diuretic dose with a standardized conversion algorithm. Outcomes included urine output during the visit, weight loss at 24 h, and hospitalization and mortality at 30 days. Safety outcomes included hypokalemia and worsening of renal function. Outcomes were analyzed across subgroups defined by maintenance diuretic dose and ejection fraction (EF).

RESULTS The median age of the cohort was 70 years (interquartile range [IQR]: 58 to 80 years), and the median daily loop diuretic dose was 240 mg (IQR: 80 to 800 mg) oral furosemide or equivalent. Twenty-six patients (43.3%) were women, and 36 (60%) had an EF ≤45%. For the entire cohort, the median urine output and 24-h weight loss were 1.1 l (IQR: 0.6 to 1.4 l) and 1.1 kg (IQR: 0.2 to 1.9 kg), respectively. Outcomes were similar across patients with varying maintenance diuretic doses (<40 mg, 40 to 160 mg, 160 to 300 mg, or >300 mg of furosemide or equivalent) and in patients with reduced or preserved EF. Transient worsening of renal function and hypokalemia occurred in 10 patients (8.9%) and 4 patients (3.5%). Although hospitalization was reported as imminent for 28 patients (52.8%), the observed rate of all-cause hospitalization was 31.7% at 30 days with no deaths.

CONCLUSIONS Short courses of IV diuretics for volume management in patients with HF were safe and associated with significant urine output and weight loss across a wide range of maintenance diuretic doses and EF. This strategy may provide an alternative to hospitalization for the management of selected HF patients. (J Am Coll Cardiol HF 2016;4:1–8)

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ABBREVIATIONS AND ACRONYMS

HF = heart failure

HFpEF = heart failure with preserved ejection fraction

HFrEF = heart failure with reduced ejection fraction

IQR = interquartile range

IV = intravenous

Since heart failure (HF)-related hospitalizations typically result from worsening congestion, loop diuretics are administered as the mainstay of therapy in 90% of HF hospitalizations (1,2). Fiscal incentives to reduce the burden of hospital admissions for HF management have fueled interest in ambulatory strategies for the management of HF decompensation, including clinic-based administration of intravenous (IV) diuretics (3–7).

Limited data are available regarding the use of IV diuretics for the ambulatory treatment of decompensated HF (3–8). Although several studies provide clinicians with guidance on diuretic dosing strategies for hospitalized patients, no such guidance exists for use in ambulatory patients (9–12). It also remains unclear whether a strategy of ambulatory IV diuretic administration is a reasonable alternative to hospital admission for selected patients with worsening HF. In this paper, we report on the safety and efficacy of IV diuretic administration according to a standardized dosing guideline used in our ambulatory HF treatment unit.

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METHODS

SETTING. The Ambulatory Cardiac Triage, Intervention, and Education (ACTIVE) Unit at Brigham and Women's Hospital is an ambulatory treatment clinic that provides advanced care to patients with early HF decompensation. The Brigham and Women's Heart and Vascular Center provided funding for this initiative. Eligible patients include hemodynamically stable (systolic blood pressure >90 mm Hg) ambulatory patients with chronic HF (regardless of left ventricular ejection fraction [EF]) and clinical signs and symptoms of worsening congestion. Patients with advanced or end-stage chronic kidney disease, concern for an acute cardiovascular or medical condition precipitating HF (e.g., new-onset arrhythmia, acute coronary syndrome, pulmonary embolism), severe symptoms, massive volume overload (e.g., >10 to 15 lb of estimated fluid weight) or anasarca, need for emergent medical treatment, or perceived high risk of clinical instability with outpatient treatment are instead referred to the emergency department or inpatient ward for further evaluation.

A multidisciplinary team of physicians, pharmacists, and nurses provides a comprehensive package of services to patients with advanced HF. The dedicated clinic space includes 2 infusion chairs with cardiac telemetry, local medication storage, infusion equipment, and an en suite bathroom. The unit can accommodate up to 4 patients per day (2 in the morning session and 2 in the afternoon session) for a 3-h IV diuretic infusion. Patients are typically scheduled for same-day or next-day treatment depending on the time of presentation to the ambulatory cardiovascular clinics and are rebooked for repeat visits as needed. Direct patient care is provided by a dedicated nurse, with supervision from a specialized nurse practitioner. At each clinic visit, nurses place an IV line, obtain a detailed medical history, provide HF education, administer medications, and monitor cardiac telemetry. A clinical pharmacist performs a detailed medication reconciliation, evaluates medication adherence, provides medication education, and optimizes medications for comorbid conditions with careful attention to drug interactions. Specialty consultation with nutrition, diabetes, and palliative care specialists is arranged on an as-needed basis.

STUDY PATIENTS. All patients who received treatment with IV furosemide in the Brigham and Women's Hospital ACTIVE Unit between September 1, 2013 and February 15, 2014 were included in this analysis. Electronic medical records were reviewed for patient demographic characteristics and outcomes.

INTERVENTIONS. IV furosemide doses were determined according to a standardized protocol based on the patient's home diuretic dose (**Figure 1**). Patients were assigned to 1 of 4 protocol groups based on their total daily dose of home oral diuretic (maintenance dose). All doses were expressed in milligrams of oral furosemide, and torsemide or bumetanide doses were converted to an equivalent furosemide dose using standard conversion guidelines (oral furosemide 80 mg = IV furosemide 40 mg = IV torsemide 20 mg = IV bumetanide 1 mg).

Patients in the low-dose group (maintenance dose ≤40 mg) received an IV bolus of furosemide 40 mg followed by a 60-mg infusion delivered over 3 h. Standard-dose group patients (maintenance dose, 41 to 160 mg) received a furosemide IV bolus dose that was equivalent numerically to the oral maintenance dose (in furosemide equivalents) with a 3-h continuous infusion at a rate of 20 mg/h. High-dose group patients (maintenance dose, 161 to 300 mg) received an IV bolus of furosemide 200 mg followed by a 3-h continuous infusion at a rate of 20 mg/h. If high-dose patients had inadequate urine output after 90 min of the continuous infusion, they were eligible to receive a second IV bolus of furosemide 200 mg. Patients with a maintenance dose >300 mg furosemide equivalent were categorized into the mega-dose group and were eligible for optional premedication with a