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Use of Intravenous Diuretics on Day of Discharge in Adults Hospitalized for Heart Failure

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Substantial hospital-level variation has been documented for readmission rates after hospitalization for heart failure.¹ The factors causing this variation, however, have not been well characterized. A recent study of Medicare beneficiaries over a 14-year period revealed a trend of shortening lengths of stay accompanied by increasing readmission rates for patients hospitalized with heart failure,² suggesting premature discharge may be playing a role in readmission.

Guidelines recommend that adults hospitalized for heart failure be transitioned from intravenous diuretics to an oral regimen on which they are stable before hospital discharge.^{3,4} This practice is intended to ensure that patients remain stable on the oral drug regimen with which they are discharged. We evaluated the extent to which hospitals

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Disclosures

None.

complied with this recommendation by calculating the proportion of patients hospitalized for heart failure who had orders for intravenous diuretics on the day of discharge. We also evaluated the association between this proportion and length of stay for heart failure among hospitals.

We conducted a cross-sectional study using data from Perspective, a voluntary, fee-supported database developed by Premier, Inc. (Charlotte, NC) for measuring quality and health care use. As of 2011, Perspective contained data from more than 400 hospitals in the United States and represented approximately 20% of all acute care inpatient hospitalizations nationwide.

We included hospitalizations for which the principal discharge diagnosis was heart failure (*International Classification of Diseases*, 9th revision, clinical modification codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.xx). Hospitalizations were excluded if patients were <18 years of age, transferred to another hospital, on hemodialysis, hospitalized for 48 hours or less, or died during their hospital stay. Hospitalizations at hospitals with less than 25 heart failure cases during the study period were also excluded.

For each hospital, we evaluated the proportion of heart failure hospitalizations during which intravenous diuretic therapy was administered on the day of discharge. We compared hospital characteristics among tertiles of hospitals based on the proportion of heart failure hospitalizations in which intravenous diuretics were administered on the day of discharge. We evaluated trends over time using the Wilcoxon rank-sum test. All analyses were conducted using SAS 9.3 (SAS Institute Inc., Cary, NC) and Stata 13 (StataCorp, College Station, TX).

We identified 115,322 hospitalizations at 433 hospitals across the United States in 2011 that met our enrollment criteria. Of these hospitals, 266 (61%) had more than 200 beds, 318 (73%) were nonteaching, and 333 (77%) were located in urban settings.

At the median hospital in 2011, intravenous diuretics were administered on the day of discharge in 24% of heart failure hospitalizations (interquartile range: 14%, 32%). Hospitals that were small (<200 beds), located in the South, nonteaching, and served rural populations demonstrated greater discharge day use of intravenous diuretics in heart failure patients (Table 1). Hospital length of stay was similar among tertiles of hospitals based on proportion of hospitalizations in which intravenous diuretics were administered on discharge day.

Use of intravenous diuretics on the day of discharge increased over time, rising from 18% of heart failure hospitalizations at the median hospital in 2005 to 24% in 2011 (P value for trend = .01). During the same period, there was a modest decline in median hospital length of stay for heart failure hospitalizations during which intravenous diuretics were used on discharge day (P value for trend = .03), but no statistically significant change in length of stay for all heart failure hospitalizations (P value for trend = .13) (Table 2).

In conclusion, we found substantial variation among hospitals in use of intravenous diuretics on the day of discharge in heart failure patients. This practice was common, occurring in 1

of 4 heart failure patients at the median hospital, indicating that guidelines regarding transition to oral diuretics before hospital discharge were not followed in a large proportion of these patients. In addition, we found a significant trend of increasing use of intravenous diuretics on the day of discharge in patients hospitalized with heart failure over the study period. Further studies are needed to determine the clinical significance of this practice, including its potential impact on readmission rates.

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Table 1

Hospital Characteristics (in 2011) Stratified by Tertiles of Proportion of Heart Failure Patients Receiving Intravenous Diuretics on Discharge day

Hospital Characteristics	Hospitals With Lowest Use of IV Diuretics on Discharge Day (<18% of HF Hospitalizations) n = 142	Hospitals With Intermediate Use of IV Diuretics on Discharge Day (18-30% of HF Hospitalizations) n = 149	Hospitals With Highest Use of IV Diuretics on Discharge Day (>30% of HF Hospitalizations) n = 142
Number of beds, n (%)			
200	51 (36%)	42 (28%)	74 (52%)
201-400	55 (38%)	62 (42%)	46 (32%)
401-600	22 (15%)	31 (21%)	18 (13%)
>600	15 (10%)	13 (9%)	4 (3%)
Geographic region, n (%)			
Midwest	46 (32%)	32 (22%)	22 (15%)
Northeast	28 (20%)	19 (13%)	18 (13%)
South	45 (31%)	67 (45%)	76 (54%)
West	24 (17%)	30 (20%)	26 (18%)
Population served, n (%)			
Urban	112 (78%)	123 (83%)	98 (69%)
Rural	31 (22%)	25 (17%)	44 (31%)
Teaching status, n (%)			
Nonteaching	104 (73%)	104 (70%)	110 (77%)
Teaching	39 (27%)	44 (30%)	32 (23%)
Length of stay, median (IQR)	4 (4, 5)	4 (4, 5)	4 (4, 4)

HF, heart failure; IQR, interquartile range; IV, intravenous.

Table 2

Use of Intravenous Diuretics on Discharge Day and Hospital Length of Stay for Heart Failure Hospitalizations Between 2005 and 2011

Metric	Year							P Value for Trend
	2005	2006	2007	2008	2009	2010	2011	
Proportion of hospitalizations in which IV diuretics were used on discharge day at the median hospital	16%	18%	19%	21%	21%	21%	24%	.01
Median hospital length of stay								
All HF hospitalizations	5	4	4	4	4	4	4	.13
IV diuretics used on discharge day	4	4	4	4	3	3	3	.03
IV diuretics not used on discharge day	5	5	5	5	5	5	5	NA

HF, heart failure; IQR, interquartile range; IV, intravenous; NA, not available.