Original Article

A prospective, randomized study to evaluate the efficacy of various diuretic strategies in acute decompensated heart failure

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ABSTRACT

Aim: To evaluate the safety and efficacy of various initial strategies of loop diuretic administration in patients with acute decompensated heart failure (ADHF) on diuresis, renal function, electrolyte balance and clinical outcomes.

Methods: Consecutive patients admitted with ADHF were randomized into three groups - intravenous furosemide infusion + intravenous dopamine, intravenous furosemide bolus in two divided doses and intravenous furosemide continuous infusion alone. At 48 h, the treating physician could adjust the diuretic strategy. Primary endpoint was negative fluid balance at 24 h after admission. Secondary end points were duration of hospital stay, negative fluid balance at 48, 72, 96 h, the trend of serum electrolytes, and renal function and 30 day clinical outcome (death and emergency department visits).

Results: Overall ninety patients (thirty in each group) were included in the study. There was a greater diuresis in first 24 h ($p = 0.002$) and a shorter hospital stay ($p = 0.023$) with the bolus group. There was no significant difference in renal function and serum sodium and serum potassium levels. There was no difference in the number of emergency department visits among the three groups.

Conclusion: All three modes of diuretic therapies can be practiced with no difference in worsening of renal function and electrolyte levels. Bolus dose administration with

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its rapid volume loss and shorter hospital stay might be a more effective diuretic strategy.

1. Introduction

Acute decompensated heart failure (ADHF) is a common cause for admission to intensive care units. Most of these patients are treated with intravenous diuretics.[1] Though diuretics are the mainstay of treatment from many years, there are very few randomized and prospective trials to guide therapy and most of the guidelines are formulated upon opinion of experts.[2,3] Not all patients with heart failure respond equally to diuretics. The response is altered by renal impairment, drug interactions, variations in splanchnic flow and drug metabolism.[4–8] Though different protocols of diuretic therapy have been tried; there is no definite consensus as to which therapy is preferable. Hence, we conducted a prospective, randomized study to evaluate the efficacy of various diuretic strategies in acute decompensated heart failure.

2. Aim

To evaluate the safety and efficacy of various initial strategies of loop diuretic administration in patients with ADHF; on diuresis, renal function, electrolyte balance and clinical outcomes.

3. Material and method

This study was conducted from April 2010 to June 2012 at the intensive cardiac care unit of Madras Medical Mission Hospital, Chennai, India.

3.1. Inclusion criteria

- ≥18 years old
- Patients with prior clinical diagnosis of heart failure (HF) on daily home use of oral loop diuretic for at least one month
- Patient identified within 24 h of hospital admission
- HF was defined by at least one symptom (dyspnea, orthopnea, or edema) and one sign (rales on auscultation, peripheral edema, ascitis) or pulmonary vascular congestion on chest radiography
- Anticipated need for intravenous loop diuretics for at least 48 h
- Willingness to provide informed consent
- May be planned for intravenous dopamine (Dopa) infusion for heart failure.

3.2. Exclusion criteria

- Systolic BP <90 mmHg
- Serum creatinine >3.0 mg/dl at baseline or renal replacement therapy
- Patient planned for a procedure requiring intravenous contrast dye during the present admission.

Patient selection and treatment protocol – We prospectively enrolled consecutive patients with ADHF admitted to the emergency department of Madras Medical Mission, Chennai. They were administered a bolus of intravenous furosemide 40 mg. Then they were randomized into three

Table 1 – The demographic data of the patients in the three groups.					
	Total	Infusion + Dopa (n = 30)	Bolus (n = 30)	Infusion (n = 30)	P value
Age (years)	58.22 ± 15.45[a]	56.07 ± 16.6	59.27 ± 16.46	59.32 ± 13.41	0.653
Male	66 (73.3%)	20/(66.7%)	23/(76.7%)	23/(76.7%)	0.6
Diabetes	49 (54.4%)	14/(46.7%)	18/(60.0%)	17/(56.7%)	0.559
Hypertension	53 (59%)	20/(66.7%)	17/(56.7%)	16/(53.3%)	0.553
Coronary Artery Disease	35 (39%)	12/(40.0%)	10/(33.3%)	13/(43.3%)	0.719
Smoker	16 (17.8%)	4/(13.3%)	6/(20.05%)	6/(20.0%)	0.738
Alcoholic	7 (7.8%)	4/(13.3%)	1/(3.3%)	2/(6.7%)	0.338
Dyspnea	80 (88.9%)	26/(86.7%)	25/(83.3%)	29/(96.7%)	0.232
Paroxysmal nocturnal dyspnea and orthopnea	53 (58.9%)	16/(53.3%)	17/(56.7%)	20/(66.7%)	0.551
Edema	35 (38.9%)	12/(40.0%)	13/(43.3%)	10/(33.3%)	0.721
Ascitis	7 (7.8%)	2/(6.7%)	3/(10.0%)	2/(6.7%)	0.856
Antiplatelets	68 (75.6%)	22/(73.3%)	23/(76.7%)	23/(76.7%)	0.942
Statin	55 (61.1%)	16/(53.3%)	17/(56.7%)	20/(66.7%)	0.551
Angiotensin converting enzyme inhibitors	35 (38.9%)	10/(33.3%)	13/(43.3%)	12/(40.0%)	0.721
Angiotensin receptor blockers	7 (7.8%)	0/(0.0%)	2/(6.7%)	5/(16.7%)	0.053
Beta blockers	39 (43.3%)	16/(53.3%)	14/(46.7%)	9/(30.0%)	0.171
Spironolactone	16 (17.8%)	6/(20.0%)	6/(20.0%)	4/(13.3%)	0.738
Pulse (beats per minute)	93.88 ± 27.18[a]	96.33 ± 36.60	92.93 ± 17.83	92.40 ± 24.51	0.793
Systolic BP (mmHg)	126.08 ± 27.21[a]	114.53 ± 20.03	130.80 ± 28.81	131.60 ± 28.47	0.01
Diastolic BP (mmHg)	77.77 ± 16.25[a]	69.53 ± 8.31	80.37 ± 15.08	84.77 ± 21.41	0.001

[a] Mean ± 2SD (standard deviation), Dopa = dopamine.