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Evidenced-Based Diuretic Management of Hospitalized Heart Failure Patients

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Every year in the United States more than one million people are hospitalized with symptoms of heart failure. Over the past few years, important data has become available on how to more effectively use diuretics to relieve symptoms quickly and durably. In this brief review, we summarize the salient points on acute heart failure treatment using diuretics.

Relief of Symptoms Within 72 Hours

From the Diuretic Optimization Strategies Evaluation (DOSE) trial, we learned that 72 hours is a reasonable time point in which to expect adequate diuresis and relief of congestion. Patients who are doing well at the 72-hour mark can continue on the same strategy until fully decongested, whereas those not responding adequately or who have developed diuresis-related complications can have their regimen altered accordingly. The 72-hour time point allows adjustment of therapy early enough that overall length of stay is still manageable.

The DOSE trial also confirmed that no one diuretic strategy is superior to any other, provided an effective dose is utilized from the outset. Whether the diuretic is given intermittently or continuously did not alter the overall outcome for patients. Current evidence further suggests that the starting dosage of a loop diuretic is of less importance to the final patient outcome than is regular assessment of the response to the dose and adjustment of any subsequent doses to produce the desired urine output. Most clinical trials of diuretics use a stepped dosing scheme with upward adjustment based on urine output response. This differs from routine clinical practice in which a fixed dose of diuretic is usually given for the duration of hospitalization. Other clinical trials have demonstrated that every eight hours or T.I.D dosing of bumetanide and furosemide results in more complete decongestion and improved clinical outcomes. Moreover, the shorter dosing interval is more consistent with the clinical pharmacology of these loop diuretics, and also results in nine doses being given in 72 hours versus six doses when the typical twice daily regimen is used. Table 1 outlines the current evidence-based diuretic regimen for hospital treatment of acute heart failure.

Worsening Renal Function

The presence of baseline renal dysfunction shifts the diuretic dose-response curve to the right such that a higher dose of loop diuretic is required to achieve the same degree of diuresis. The Cardiorenal Rescue Study in Acute Decompensated Heart Failure (CARRESS-HF) trial provided evidence that using sequentially acting diuretics such as metolazone followed by intravenous furosemide can be very effective for diuresis in patients with baseline renal dysfunction (see Table 1 on reverse).

A common conundrum with diuretic treatment is worsening renal function, which develops in as many as 25-30 percent of patients. The etiology of this complication is multifactorial, but a consistent underlying pathophysiologic event appears to be decreased glomerular filtration pressure gradient which can result from either a fall in mean arterial pressure (afferent pathway) or a persistent elevation of central venous pressure (efferent pathway) or a combination. A preponderance of the evidence supports the latter as being more important.

The automatic response to worsening renal function is to stop all diuretics. While this may be appropriate in patients with clear evidence of intravascular volume depletion as the etiology, it may not be the correct response for patients with ongoing congestion and persistently elevated CVP. For the latter patients, the addition of a vasodilator with continued diuresis is likely the proper therapeutic response. The key is to personalize patient care by considering the etiology on a case-by-case basis before withholding critical therapy such as diuretics. Current evidence shows the best way to minimize worsening renal function is to avoid reducing the blood pressure during diuresis and to closely monitor urine output and adjust diuretic dosage to limit both over-diuresis (intravascular depletion mechanism) and under-diuresis (elevated CVP mechanism).

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Table **1**. **Diuretic Management in Acute Heart Failure**

Intermittent Regimen	Typical Dose	Dosing Interval	Max Daily Dose
Bumetanide	1 to 2mg	TID or BID	10mg
Furosemide	40–160mg	BID or TID	320mg
Torsemide	20mg	BID	200mg
Continuous Infusion	**Loading Dose**	**Infusion Rate**	
Bumetanide	1mg I.V.	0.5 to 2.0mg per hour	
Furosemide	40mg I.V.	10 to 40mg per hour	
Torsemide	20mg I.V.	5 to 20mg per hour	
Sequential Blockade	**Typical Dose**	**Dosing Interval**	**Max Daily Dose**
Metolazone	2.5 to 10mg	QD or BID	10mg
Hydrochlorothiazide	25 to 100mg	QD	100mg
Chlorthalidone	25 to 50mg	QD	200mg
Discharge Regimen	**Dosage**	**Dosing Interval**	**Duration of Action**
Bumetanide	0.5 to 1mg	BID	4 to 6 hours
Furosemide	20 to 40mg	QD or BID	6 to 8 hours
Torsemide	10 to 20mg	QD	12 to 16 hours
Spironolactone	12.5 to 25mg	QD	36 to 48 hours

Choice of Diuretic on Discharge Impacts Readmission

Recent evidence suggests most patients should be discharged on more rather than less oral diuretics than their prior outpatient dose. In one study, those patients discharged on higher dose of oral diuretic had a 30-day readmission rate half that of patients sent home on the same or lower dose than their preadmission dosage. As an alternative to high doses of furosemide in those with renal dysfunction, a switch to torsemide (Demadex) at discharge has been shown to produce ongoing decongestion, better cardiovascular outcomes and reduction in readmission rate. Bumetanide also has a very high oral bioavailabilty and results in continued decongestion after discharge, though there is no data outcomes are better compared to equivalent dose of furosemide.

Conclusion

Diuretics represent the main tool available to clinicians for relief of heart failure symptoms and appropriate use is directly related to improved quality of life, reduced length of stay and reduction of readmission. Because of the variable individual response, the concept of personalized medicine truly applies to managing symptoms of acute heart failure. The initial dose of diuretic should not only be carefully chosen, but subsequent doses throughout the hospitalization should be adjusted to produce ongoing diuresis and symptom relief. The presence of existing or worsening renal dysfunction challenges the clinician to adapt diuretic therapy accordingly and avoid exacerbating the situation further.

Upcoming Conferences

Save the dates for two free cardiovascular conferences.

Saturday, September 17 | 7am–3pm

Cardiac Arrhythmia Conference 2016
Renaissance Tampa International Plaza Hotel | Tampa
For more information: SJHCardioConference.org

Saturday, October 22 | 8am–2pm

2016 Cardiovascular Conference
Innisbrook Resort and Golf Club | Palm Harbor
For more information: MPMCardioConference.org

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