Outpatient Ultrafiltration to prevent Hospital Readmission During COVID-19 Pandemic in Diuretic Intolerant Patient: Case Study

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Introduction

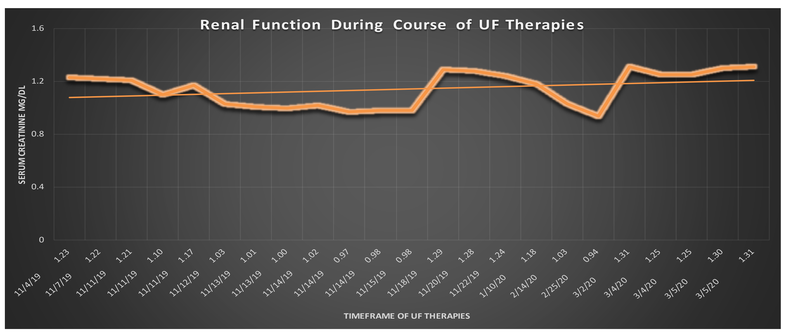
Heart Failure (HF) is the leading cause of hospitalization among adults >65 years of age in the US (1). HF affects 6.5 million people in the U.S. and results in more than 750,000 hospitalizations annually (2). Despite advances in medical therapeutics, mortality remains high (3). Adjustments in workflow across hospital systems have been instituted to reduce hospitalizations and readmissions. Ambulatory HF clinics have helped decrease hospitalization rates. In the current COVID-19 pandemic, the need to minimize utilization of hospital resources and limit patient hospital admissions is even more paramount. Inpatient ultrafiltration (UF) has been utilized frequently to improve congestion in patients with acute decompensated heart failure (ADHF)and has been well reported in the literature (4). Less is known of outpatient utilization of UF in the ambulatory heart failure patient. We present a case of outpatient UF to reduce congestion in an ambulatory heart failure patient to minimize hospitalization in the era of COVID-19 pandemic.

Methods

Isolated veno-venous UF is a method of decongestion that can be used as an alternative to loop diuretics. With UF, plasma water is removed from whole blood across a semipermeable membrane (hemofilter) in response to a transmembrane pressure gradient that is driven by hydrostatic forces generated by extracorporeal pumps. These hydrostatic forces can be adjusted manually, allowing for tightly controlled UF fluid removal rates. The solute concentration in the ultrafiltrate is equal to that in the water component of the plasma, allowing for effective isotonic sodium removal from the patient. Simplified UF devices permit effective ultrafiltration using a peripheral venous access, low blood flows, and a small extracorporeal blood volume. This therapy has been used in ADHF patients with marked volume overload and diuretic resistance to achieve effective decongestion. Several reported benefits have been postulated with UF therapies over that of diuretics (see table 4). Previous experience with intermittent outpatient UF utilizing peritoneal dialysis and hemofiltration has been reported (5).

We now know that patients with pre-existing cardiac and pulmonary disease, including congestive heart failure, are at higher risk of serious complications from exposure to SARS-COVID-2 virus. Several institutional paradigms have rapidly shifted to manage this higher risk for HF patients, including increased utilization of tele-health visits, video phone call visits, ambulatory pulmonary pressure monitoring, and device-based fluid monitoring for these patients. We report a novel case of minimizing exposure risk of a congested HF patient using outpatient isolated veno-venous UF in the ambulatory setting with the Aquadex Smartflow system.

Figure 1. Change in Creatinine During Course of Outpatient UF Therapies.



Case Study

A 70-year-old female with HF preserved ejection fraction, combined pre and post pulmonary capillary hypertension, interstitial lung disease, right ventricular dysfunction, with chronic dyspnea on continuous home oxygen, maintaining in New York Heart Association class III. The patient has had a complicated course with multiple hospitalizations due to recurrent congestion, with decongestion therapies limited by dermatologic biopsy proven allergy to sulfa based diuretics. She had failed various diuretic regimens, including bumetanide, furosemide, hydrochlorothiazide, and torsemide with recurrent desquamating whole body rash. She was unable to afford ethacrynic acid. She had undergone effective inpatient UF during her last hospitalization in November 2019 with effective decongestion tolerating outpatient low dose acetazolamide diuretic. She had recurrent weight gain of 12 lbs. during the COVID-19 pandemic, and again was refractory to outpatient therapies. Given her co-morbidities, she was deemed high risk for exposure. A decision to proceed with outpatient UF was made. The day of outpatient HF clinic visit, we placed a brachial dual lumen 16-gauge extended length catheter from CHF solutions. A heparin drip was initiated thirty minutes prior to the start of the UF per UF protocol. Labs were drawn in am, and baseline serum creatinine was 1.24 mg/dl and estimated GFR was 44. The initial outpatient session was a 4-hour outpatient session of isolated veno-venous UF utilizing the Aquadex Smartflow system performed with 200 cc/hr ultrafiltrate removal. The subsequent sessions were for 6 hours with 250cc/hr ultrafiltrate removal. A total of 850 L of isotonic fluid was removed during one session. The patient was brought back for a total of 4 sessions, and total fluid removal over the course of 4 days was 4950L. The patient immediately improved clinical symptoms, and has effectively maintained in the outpatient setting, minimizing her exposure. Table 1 shows how her creatinine levels maintained within her baseline range. Table 2 shows her weight change.

Figure 2. Change in Weight over 6 months with Outpatient UF Therapies.

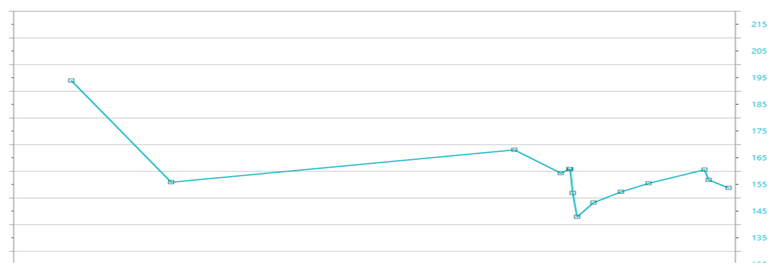
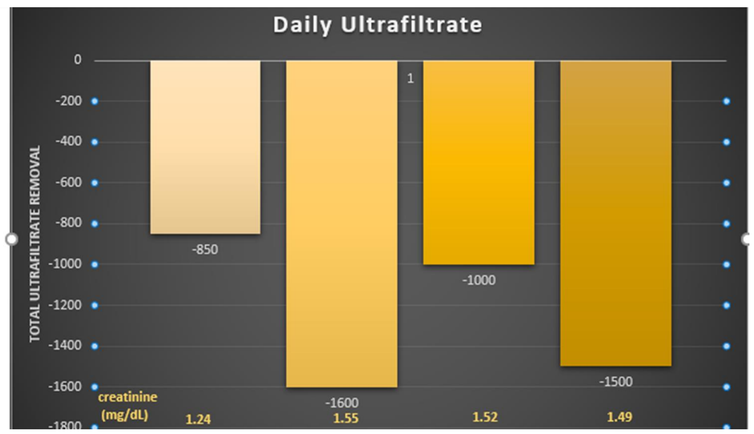


Figure 3. Outpatient Ultrafiltrate Volume Removal per Session



Discussion

Ultrafiltration is a valuable therapy for fluid removal in the decompensated HF patient. It is currently utilized in the inpatient setting for patients with ADHF with marked volume overload and diuretic resistance to achieve effective decongestion. There are many benefits of UF therapy over that of diuretics. Our case study shows an example of how this therapy may be used safely in the outpatient environment. Whether it is used inpatient or outpatient it is safe and effective and should be considered as an alternative to diuretic therapy. The more clinicians use UF, the more comfortable they will be with prescribing this system and will see the various benefits firsthand.

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Disclosures:

Author Disclosure Information:
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Figure 4. Benefits of Diuretics versus Ultrafiltration

Diuretics Vs Ultrafiltration

Diuretics	Ultrafiltration
Direct neurohormonal activation	No direct neurohormonal activation
Elimination of hypotonic urine	Removal of isotonic plasma water
Unpredictable elimination of sodium and water	Precise control of rate and amount of fluid
Development of diuretic agent resistance with prolonged administration	Restoration of diuretic agent responsiveness
Risk of hypokalemia and hypomagnesemia	No effect on plasma concentration of potassium and magnesium
Peripheral venous access	Peripheral or central venous catheter
No need for anticoagulation	Need for anticoagulation
No extracorporeal circuit	Need for extracorporeal circuit