Brasília, January 14, 2022.

Thiago Reis, MD[a,b]

[a] Laboratory of Molecular Pharmacology, University of Brasília, Brasília, Brazil

[b] Department of Kidney Transplantation, Clínica de Doenças Renais de Brasília - DF Star Hospital, Brasília, Brazil

Ultrafiltration with Peripheral Venous Access in Acute Decompensated Heart Failure

Case Vignette

A 82-year-old woman was admitted to the intensive care unit (ICU) with signs and symptoms compatible with acute decompensated heart failure [1],[2]. Her underlying conditions were Chagas cardiomyopathy [3] causing heart failure with reduced ejection fraction, and chronic kidney disease stage 4 secondary to cardiorenal syndrome type 2 [4]. At the admission she presented AKI stage 1 and despite association of escalating doses of loop diuretics her fluid balance was positive after 24 hours of treatment without symptoms improvement [5].

Proposed adjuvant treatment: slow continuous ultrafiltration (SCUF) with peripheral venous access [6],[7].

Settings

•Venous access: 6.5 Fr x 10 mm pediatric catheter (Joline GmbH, Hechingen, Germany), inserted into the right basilic vein.

•Anticoagulation: unfractionated heparin or no anticoagulation.

•Blood flow: 40 mL/min.

•Machine: PrismafleX or PrismaX (Baxter Healthcare Corporation, Deerfield, IL, USA).

•Filter: HF20 (Gambro, Lund, Sweden).

Short Comment:

•Machines dedicated to ultrafiltration provide ultrafiltration with low blood flows (40 mL/min) enabling less invasive and traumatic venous access. Instead of a traditional 13 Fr catheter placed in a central venous site, a thinner catheter is inserted peripherally into the basilic vein. Additionally, these machines have a reduced amount of blood volume in the extracorporeal circuit, providing minimal blood loss in case of circuit coagulation/clot. Notably, an adult CRRT set such as the ST150 displays a priming volume of 193 mL and a recommend blood flow ranging from 100-450 mL/min.

Our Department of Nephrology does not possess a machine dedicated to ultrafiltration. Aiming to emulate devices developed to SCUF, we used a PrismafleX machine in the SCUF modality with the HF20 pediatric set (circuit volume 58 mL). A 6.5 Fr pediatric double lumen catheter was inserted into the right basilic vein enabling a blood flow of 40 mL/min (recommend blood flow by the manufacturer ranging from 20-100 mL/min).

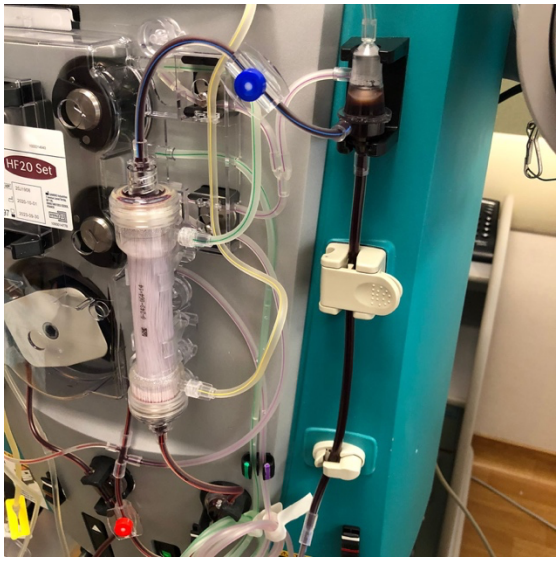

Figure 1 - Extracorporeal circuit.

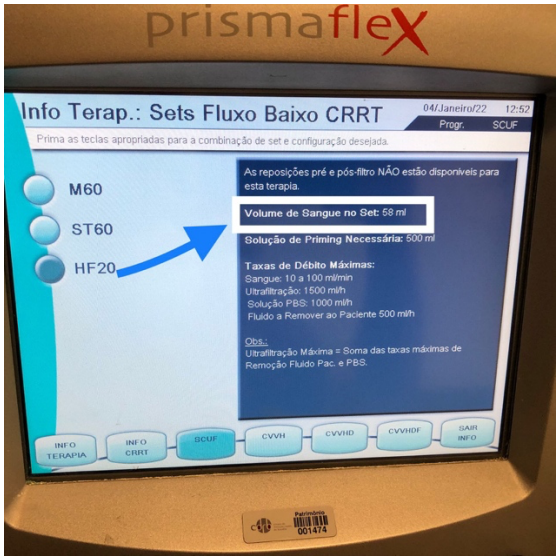

Figure 2 - Arrow: HF20 priming volume 58 mL.

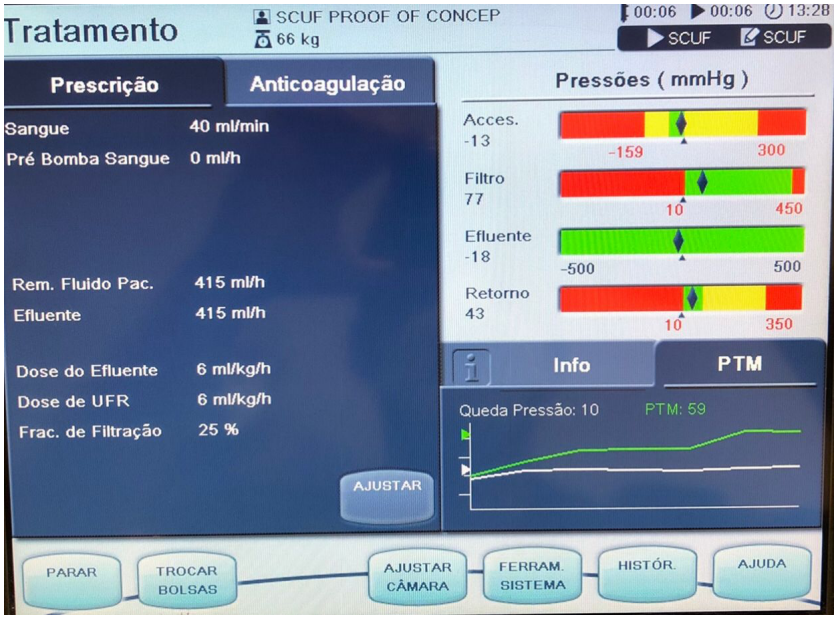

Figure 3 - Blood (Sangue) 40 mL/min; ultrafiltration rate (Rem. Fluido Pac.) 415 mL/h; Filtration Fraction (Frac. de Filtração) 25%; Transmembrane Pressure - TMP (PTM) 59 mmHg.

Figure 4 - Catheter specifications.

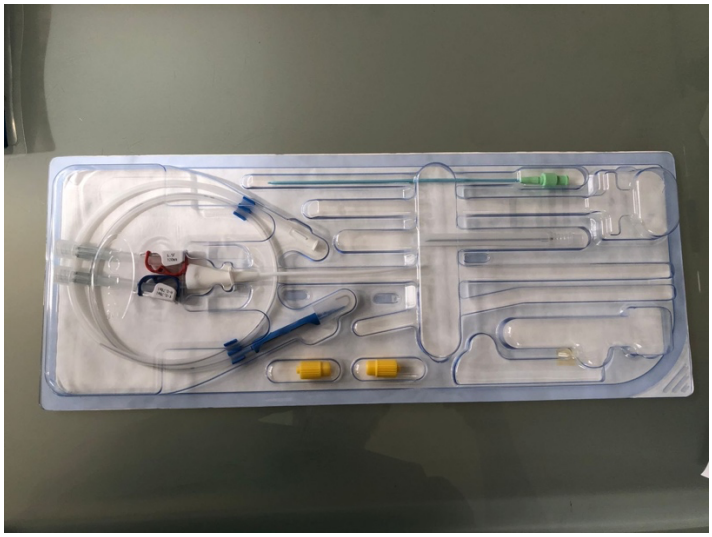

Figure 5 - Catheter kit.

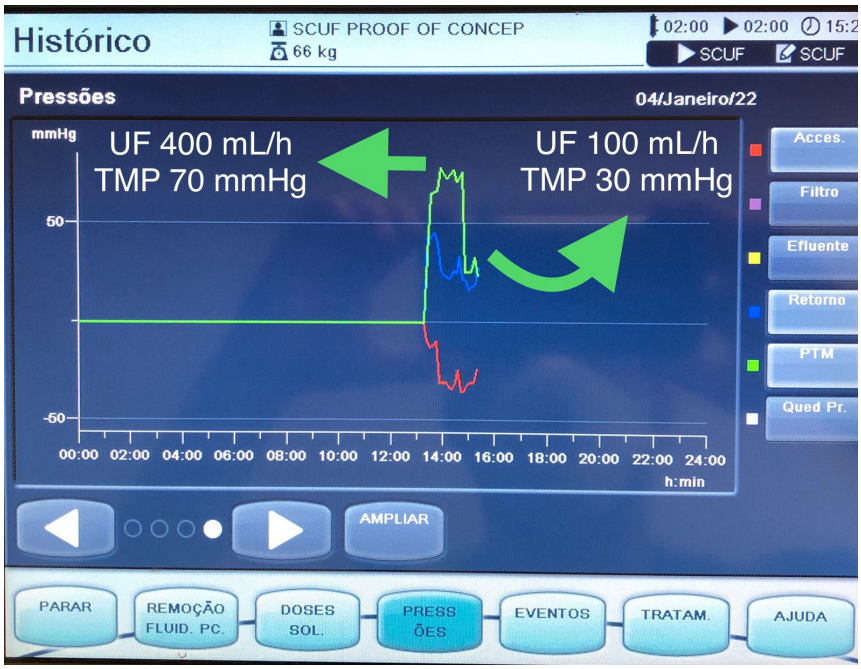

Figure 6 - Circuit pressures (y-axis pressure, x-axis time). Arterial line pressure (red) around -25 mmHg; venous line pressure (blue) around +30 mmHg; transmembrane pressure (TMP) (arrow - green) with ultrafiltration (UF) rate of 400 mL/h was 70 mmHg, at 3pm UF rate was reduced to 100 mL/h with expected reduction in the convective clearance, reflecting in a reduction of TMP to 30 mmHg.

Figure 7 - Middle column, hourly ultrafiltration volume; right column, total ultrafiltration volume.

Suggested readings:

1. Boorsma EM, ter Maaten JM, Damman K, Dinh W, Gustafsson F, Goldsmith S, et al. Congestion in heart failure: a contemporary look at physiology, diagnosis and treatment. Nat Rev Cardiol. 2020;17: 641–655. doi:10.1038/s41569-020-0379-7

2. Arrigo M, Jessup M, Mullens W, Reza N, Shah AM, Sliwa K, et al. Acute heart failure. Nat Rev Dis Primers. 2020;6: 16. doi:10.1038/s41572-020-0151-7

3. Nunes MCP, Beaton A, Acquatella H, Bern C, Bolger AF, Echeverría LE, et al. Chagas Cardiomyopathy: An Update of Current Clinical Knowledge and Management: A Scientific Statement From the American Heart Association. Circulation. 2018;138. doi:10.1161/CIR.0000000000000599

4. Husain-Syed F, Gröne H, Assmus B, Bauer P, Gall H, Seeger W, et al. Congestive nephropathy: a neglected entity? Proposal for diagnostic criteria and future perspectives. ESC Heart Failure. 2021;8: 183–203. doi:10.1002/ehf2.13118

5. Mullens W, Damman K, Harjola V-P, Mebazaa A, Brunner-La Rocca H-P, Martens P, et al. The use of diuretics in heart failure with congestion - a position statement from the Heart Failure Association of the European Society of Cardiology: Diuretics in heart failure. Eur J Heart Fail. 2019;21: 137–155. doi:10.1002/ejhf.1369

6. Kazory A. Ultrafiltration Therapy for Heart Failure: Balancing Likely Benefits against Possible Risks. Clin J Am Soc Nephrol. 2016;11: 1463–1471. doi:10.2215/CJN.13461215

7. Costanzo MR, Ronco C, Abraham WT, Agostoni P, Barasch J, Fonarow GC, et al. Extracorporeal Ultrafiltration for Fluid Overload in Heart Failure. J Am Coll Cardiol. 2017;69: 2428–2445. doi:10.1016/j.jacc.2017.03.528