**PICO SEARCH ASSIGNMENT WORKSHEET** **Name: Sirat Zafar**

Brief description of patient problem/setting (summarize the case very briefly)
78 yo veteran male residing in a VA long-term care facility with significant PMHx of end-stage renal disease (ESRD) and heart failure with reduced ejection fraction (HFrEF) with an ejection fraction of 20%. Patients with both of these conditions usually develop cardiorenal syndrome, making managing fluid overload difficult. These patients often experience recurrent hospitalizations due to volume overload and worsening heart failure symptoms. Providers must determine whether removing fluid through ultrafiltration during dialysis or aggressive diuretic therapy is more effective in controlling volume overload and improving clinical outcomes in geriatric patients.

**Search Question:** Clearly state the question (including outcomes or criteria to be tracked)
In elderly patients with ESRD and heart failure with reduced ejection fraction (HFrEF), does ultrafiltration during dialysis compared with high-dose diuretic therapy reduce hospitalizations for volume overload and mortality?

**Question Type:** What kind of question is this? (boxes now checkable in Word)

| | | |
|---|---|---|
| ☐Prevalence | ☐Screening | ☐Diagnosis |
| ☐Prognosis | ☐**Treatment** | ☐Harms |

Assuming that the highest level of evidence to answer your question will be meta-analysis or systematic review, what other types of study might you include if these are not available (or if there is a much more current study of another type)?
**Please explain your choices**
If meta-analysis or systematic review is not available, I would include:

- **Randomized Controlled Trials (RCTs)-** comparing pts with hf and renal disease on dialysis with either ultrafiltration or high-dose diuretic therapy. These studies are important to my PICO because they can directly evaluate outcomes such as hospitalization, mortality, fluid balance, and worsening renal function while minimizing bias through randomization.
- **Prospective cohort studies-** examining elderly patients with ESRD and heart failure who receive ultrafiltration vs intensive diuretic therapy and following them over time to assess outcomes such as hospitalization rates, symptom improvement, and mortality. These studies are useful in geriatric populations where randomized trials may be limited due to ethical or logistical challenges.
- **Retrospective cohort studies or database studies-** using large healthcare dataset such as VA or Medicare databases to evaluate real-world outcomes in elderly patients with cardiorenal syndrome. These studies can assess patterns of fluid management and compare outcomes such as hospital admissions, mortality, and complications related to both interventions across a large population.

**PICO search terms:**

| P | I | C | O |
|---|---|---|---|
| Elderly pts with ESRD and HFrEF | Ultrafiltration during dialysis | High-dose diuretic therapy | Hospitalization |
| Geriatric dialysis patients | Renal ultrafiltration | Loop diuretic | Mortality |
| ESRD with heart failure | Dialysis ultrafiltration | Medical management | Volume overload |
| Cardiorenal syndrome | Fluid removal dialysis | Diuretic therapy | HF exacerbations |

**Search tools and strategy used:**

Please indicate what databases/tools you used, provide a list of the terms you searched together in each tool, and how many articles were returned using those terms and filters.

Explain how you narrowed your choices to the few selected articles. For example, if your search returned 25 articles among the several databases used, what was the process used to determine which four articles to use?

| Database | Search Term Used | # of Results | Filters/Limiters Applied | Notes/Observers |
|---|---|---|---|---|
| PubMed | (“end-stage renal disease” OR “ESRD” OR “dialysis”) AND (“heart failure” OR “HFrEF” OR “reduced ejection fraction”) AND (“ultrafiltration” OR “dialysis ultrafiltration”) AND (“diuretics” OR “loop diuretics” OR “high-dose diuretics”) AND (“hospitalization” OR “mortality” OR “volume overload” OR “heart failure exacerbation”) | 5 results | Last 5 years, Free full text, English, Human studies | Focused on ESRD and HF patients with fluid overload. Selected a recent review discussing diuretic resistance and the role of ultrafiltration as an alternative to high-dose diuretics, following outcomes such as hospitalization and worsening HF. |
| Science Direct | ("ESRD" OR dialysis)<br>AND ("heart failure")<br>AND (ultrafiltration)<br>AND (diuretics OR "loop diuretics") | 44 results | 2022, 2023, 2024, 2025, 2026, English, Research articles | Most studies focused on hospitalized patients with acute decompensated HF and fluid overload rather than patients with only ESRD or those ONLY receiving dialysis. I reviewed research articles discussing the use of ultrafiltration for fluid overload and its impact to outcomes such as volume removal, renal function, and HF related hospitalizations. One selected study analyzed ten years of real-world clinical data to assess the effectiveness of ultrafiltration in managing congestion in HF patients. |
| Cochrane Library | ("end-stage renal disease" OR ESRD OR dialysis)<br>AND ("heart failure" OR HFrEF OR "reduced ejection fraction")<br>AND (ultrafiltration OR "dialysis ultrafiltration" OR "fluid removal")<br>AND (diuretics OR "loop diuretics" OR "high-dose diuretics")<br>AND ("volume overload" OR hospitalization OR mortality OR "heart failure exacerbation") | 1 results | Systematic reviews only | This article is a Cochrane systematic review of RCTs evaluating ultrafiltration compared with diuretic therapy in patients with acute HF, focusing on outcomes such as mortality, rehospitalization and renal function |

I used PubMed, ScienceDirect, and the Cochrane library to find studies examining ultrafiltration compared with high-dose diuretic therapy in patients with HF and ESRD or dialysis. Search terms included combinations of “heart failure”, “ultraflitration”, and “volume overload.” Filters were applied for recent publications, English language, and research or review articles. Studies were selected if they

presented outcomes like hospitalization, mortality, renal function, or effectiveness of fluid removal in heart failure patients.

**Results found:**

**Identify at least 3 articles (or other appropriate reputable sources) that answer your specific question with the highest available level of evidence** (you will probably need to look at more than 3 articles to get the 3 most focused and highest-level articles to address your question). Please make sure that they are Medline indexed.
In addition to providing the hyperlinks, the full-length articles (PDFs) must also be attached in Brightspace.
Please post the citation and abstract for each article (to include the journal and authors' names and date) and say why you chose it.
Please also note what kind of article it is (e.g. meta-analysis, cohort study, or independent blind comparison with gold standard of diagnosis, etc.).

**At the bottom of each abstract, please comment on what your key points are from this article (including any points or concepts included in the article, but not present in the abstract – i.e. make the concepts understandable to the reader)**
**Please note that if the evidence is not in the abstract, you must clearly summarize the evidence in your posting.**

1. Francisca Gomes da Silva, Rita Calça, Ana Rita Martins, Inês Araújo, Carlos Aguiar, Cândida Fonseca, Patrícia Branco, Diuretic-resistant heart failure and the role of ultrafiltration: A proposed protocol, Revista Portuguesa de Cardiologia, Volume 42, Issue 9, 2023, Pages 797-803, ISSN 0870-2551, https://doi.org/10.1016/j.repc.2022.05.012.

   Type: Narrative review

**Abstract** Acute heart failure (HF) decompensation generally manifests with signs and symptoms of congestion that strongly predict poor poor patient outcome. Loop diuretics are the cornerstone of therapy to counteract fluid overload and are widely used for acute management and chronic stabilization of HF. However, a diminished response to loop diuretics is a common problem, affecting the patient's clinical course and potentially prolonging hospitalization. Diuretic resistance is defined as failure to decongest despite appropriate and escalating loop diuretic therapy. We propose a protocol for the management of diuretic resistance. The initial approach should include an assessment of causes of pseudo-diuretic resistance. Adjustments to loop diuretic therapy, such as increasing doses and frequency of administration and sequential nephron blockade, may be successful. For hospitalized patients with progressive disease there are more invasive methods for fluid removal. Switching from oral to intravenous loop diuretics is essential to avoid variable absorption and for symptomatic relief. Extracorporeal ultrafiltration is also an option since this technique is highly effective at removing plasma fluid from blood. While extracorporeal ultrafiltration is an invasive solution, peritoneal dialysis is a home-based, intermittent therapeutic option that can enable efficient management of fluid overload, preventing HF-related hospital admission, and improving quality of life. As a last resort for fluid removal, a peritoneal dialysis regimen should fully exploit its decongestive properties and should be tailored to the patient's characteristics and clinical needs.


I chose this article because it examines use of ultrafiltration in patients with heart failure and fluid overload that is treatment resistant to diuretic medications, which is directly related to my PICO question comparing ultrafiltration with diuretic therapy. The study concludes that ultrafiltration allows controlled volume removal that does not severely and negatively affect renal function and can help alleviate symptoms of volume overload. The review suggests that ultrafiltration can be considered in specific patients with fluid retention or edema, although further studies need to determine its impact on consequences such as mortality and rehospitalization. The article also talks about how ultrafiltration can be used when high-dose diuretics can't treat the patient and overall supports its use as an adjunctive or alternative treatment therapy for managing refractory fluid overload in HF patients.

2. Donald C. Haas, Maureen Hummel, Patricia Barrella, Waqas Ullah, Misung Yi, Robert A. Watson, Ten year real world experience with ultrafiltration for the management of acute decompensated heart failure, American Heart Journal Plus: Cardiology Research and Practice, Volume 24, 2022, 100230, ISSN 2666-6022, https://doi.org/10.1016/j.ahjo.2022.100230.

   Type: Retrospective cohort study, Single-center observational study

A B S T R A C T

*Background:* Randomized controlled trials (RCT) of ultrafiltration (UF) have demonstrated conflicting results regarding its efficacy and safety.
*Objective:* We reviewed 10 years of data for adjustable UF during heart failure hospitalizations in a real world cohort.
*Methods:* We performed a retrospective, single center analysis of 335 consecutive patients treated with adjustable rate UF using the CHF Solutions Aquadex Flex Flo System from 2009 to 2019.
*Results:* Compared to previous RCTs investigating UF, our cohort was older, with worse renal impairment and more antecedent HF hospitalizations in the year preceding therapy. Mean fluid removal with UF was 14.6 l. Mean weight loss with UF was 15.6 lbs (range 0.2–57 lbs) and was sustained at 1–2 week follow-up. Mean creatinine change upon stopping UF, at discharge and follow-up (mean 30 days) was +0.11 mg/dl, +0.07 mg/dl and +0.11 mg/dl, respectively. HF rehospitalizations at 30 days, 90 days and 1 year were 12.4 %, 14.9 % and 27.3 % respectively. On average patients had 1.74 fewer hospitalizations for HF in the year following UF when compared to 12 months preceding UF. Major bleeding defined as requiring discontinuation of anticoagulation occurred in 3.6 % of patients.
*Conclusions:* Compared with previous UF trials, our study demonstrates that UF compares favorably for HF rehospitalizations, renal function response, and weight/volume loss. Importantly, our real world experience allowed for the adjustment of UF rate during therapy and we believe this is a major contributor to our favorable outcomes. In clinical practice, UF can be a safe and effective strategy for decongestion.

I selected this article because it evaluates the role of ultrafiltration in managing patients with HF who experience persistent fluid overload despite treatment with diuretics. This is relevant to my PICO comparing ultrafiltration and routine diuretic therapy in patients with HF and fluid overload. This article discusses how ultrafiltration can remove excess fluid in a controlled manner and help reduce symptoms associated with congestion when diuretic therapy is insufficient. The findings, like the previous article, suggested ultrafiltration may improve fluid management and aid in clinically stabilizing the patients, although more research is needed to clarify its effects on outcome such as mortality, hospitalization, and long-term kidney function.

3. Srivastava M, Harrison N, Caetano AFSMA, Tan AR, Law M. Ultrafiltration for acute heart failure. Cochrane Database of Systematic Reviews 2022, Issue 1. Art. No.: CD013593. DOI: 10.1002/14651858.CD013593.pub2. Accessed 06 March 2026.

Type: Systematic review

## ABSTRACT

### Background

Pharmacotherapies such as loop diuretics are the cornerstone treatment for acute heart failure (AHF), but resistance and poor response can occur. Ultrafiltration (UF) is an alternative therapy to reduce congestion, however its benefits, efficacy and safety are unclear.

### Objectives

To assess the effects of UF compared to diuretic therapy on clinical outcomes such as mortality and rehospitalisation rates.

### Search methods

We undertook a systematic search in June 2021 of the following databases: CENTRAL, MEDLINE, Embase, Web of Science CPCI-S and ClinicalTrials.gov. We also searched the WHO ICTRP platform in October 2020.

### Selection criteria

We included randomised controlled trials (RCTs) that compared UF to diuretics in adults with AHF.

### Data collection and analysis

Two review authors independently assessed trial quality and extracted data. We contacted study authors for any further information, and language interpreters to translate texts. We assessed risk of bias in included studies using Risk of Bias 2 (RoB2) tool and assessed the certainty of the evidence using GRADE.

### Main results

We included 14 trials involving 1190 people. We included people who had clinical signs of acute hypervolaemia. We excluded critically unwell people such as those with ischaemia or haemodynamic instability. Mean age ranged from 57.5 to 75 years, and the setting was a mix of single and multi-centre. Two trials researched UF as a complimentary therapy to diuretics, while the remaining trials withheld diuretic use during UF. There was high risk of bias in some studies, particularly with deviations from the intended protocols from high cross-overs as well as missing outcome data for long-term follow-up.

We are uncertain about the effect of UF on all-cause mortality at 30 days or less (risk ratio (RR) 0.61, 95% confidence interval (CI) 0.13 to 2.85; 3 studies, 286 participants; very low-certainty evidence). UF may have little to no effect on all-cause mortality at the longest available follow-up (RR 1.00, 95% CI 0.73 to 1.36; 9 studies, 987 participants; low-certainty evidence).








UF may reduce all-cause rehospitalisation at 30 days or less (RR 0.76, 95% CI 0.53 to 1.09; 3 studies, 337 participants; low-certainty evidence). UF may slightly reduce all-cause rehospitalisation at longest available follow-up (RR 0.91, 95% CI 0.79 to 1.05; 6 studies, 612 participants; low-certainty evidence).

UF may reduce heart failure-related rehospitalisation at 30 days or less (RR 0.62, 95% CI 0.37 to 1.04; 2 studies, 395 participants; low-certainty evidence). UF probably reduces heart failure-related rehospitalisation at longest available follow-up, with a number needed to treat for an additional beneficial effect (NNTB) of 10 (RR 0.69, 95% CI 0.53 to 0.90; 4 studies, 636 participants; moderate-certainty evidence).

No studies measured need for mechanical ventilation.

UF may have little or no effect on serum creatinine change at 30 days since discharge (mean difference (MD) 14%, 95% CI −12% to 40%; 1 study, 221 participants; low-certainty evidence). UF may increase the risk of new initiation of renal replacement therapy at longest available follow-up (RR 1.42, 95% CI 0.42 to 4.75; 4 studies, 332 participants; low-certainty evidence).

There is an uncertain effect of UF on the risk of complications from central line insertion in hospital (RR 4.16, 95% CI 1.30 to 13.30; 6 studies, 779 participants; very low-certainty evidence).

This study evaluates the effectiveness in ultrafiltration in patients with HF and fluid overload that was resistant to diuretic therapy. The results showed that ultrafiltration was associated with reduction in hospitalizations related to heart failure, with rehospitalization rates of 12.4% at 30 days, 14.9% at 90 days, and 27.3% at 1 year. Patients experienced an average of 1.74 fewer heart failure hospitalization in the year after ultrafiltration compared with the year prior to treatment. The study also found that controlled fluid removal didn't significantly worsen renal function. Ultrafiltration may help improve volume management and reduce HF-related hospitalizations in selected patients with diuretic-resistant congestion.

**What is the clinical "bottom line" derived from these articles in answer to your question?**

The overall evidence suggests that ultrafiltration may be beneficial for patients with HF who have persistent fluid overload that is resistant to diuretic therapy. Ultrafiltration allows controlled removal of excess fluid and can reduce symptoms of fluid retention and heart failure-related hospitalizations. However, current evidence doesn't clearly demonstrate a significant improvement in mortality or long-term outcomes compared with standard diuretic therapy. Therefore, ultrafiltration can be considered for selected patients with diuretic-resistant volume overload, but they remain the first-line treatment and additional research is needed to better define the long-term benefits and risks.