Medium Vs Low Citrate Concentration in Continuous Kidney Replacement Therapy: Positive Budget Impact Through Total Cost of Ownership Assessment

EE576

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INTRODUCTION

Use of regional citrate anticoagulation (RCA) in patients with acute kidney injury undergoing continuous kidney replacement therapy is widely accepted and recommended by international guidelines.[1] Various treatment protocols using different citrate concentrations are available, but their clinical efficiency and associated costs can vary.

OBJECTIVE

This study aimed to evaluate the economic and organizational impact of different regional citrate anticoagulation protocols in continuous kidney replacement therapy for acute kidney injury. Specifically, we compared the total cost of ownership (TCO) of medium versus low citrate concentration strategies in a UK hospital setting, assessing how treatment modality and fluid requirements influence overall hospital costs and resource use.

METHOD

- **Budget impact analysis**: A budget impact analysis was conducted over a one-year timeframe from a UK hospital perspective, on a hypothetical group of 100 patients receiving 72 hours of therapy across 300 treatment days.
- **Protocols compared**: The low citrate concentration protocol used pre-post continuous veno-venous hemodiafiltration (CVVHDF), while the medium concentration protocol applied continuous veno-venous hemodialysis (CVVHD). Both protocols assumed a circuit lifespan of 72 hours.
- **Costing approach**: Costs were based on UK framework pricing,[2] with four scenarios tested using low- and high-price bands, either assuming equal unit costs (Scenarios 1 & 2) or adjusting for citrate concentrations (Scenario 3 & 4).

RESULTS

Figure 1:

Annual cost savings with medium citrate CVVHD vs low citrate pre-post CVVHDF

- Scenario 1: £79,843 vs £102,099 – £22,256 saved (−22%)
- Scenario 2: £56,025 vs £74,364 – £18,339 saved (−25%)
- Scenario 3: £80,353 vs £90,349 – £9,996 saved (−11%)
- Scenario 4: £56,025 vs £64,756 – £8,731 saved (−13%)

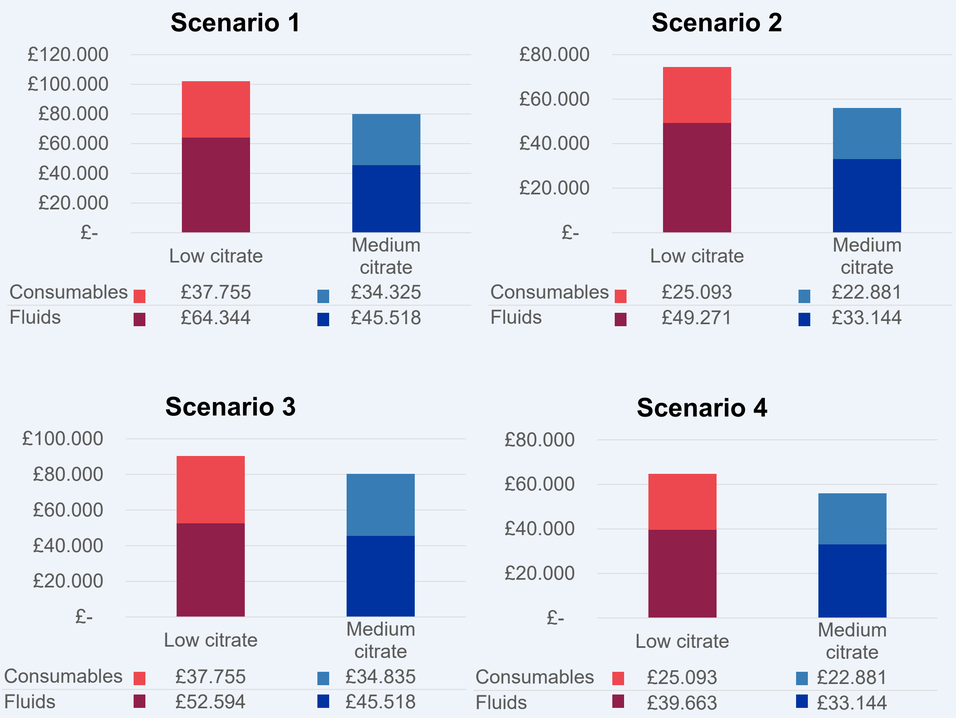
Figure 2:

Timetable of bag changes per 24 hours with medium citrate CVVHD vs low citrate pre-post CVVHDF.

- Per day: 47 vs 106 bag changes, -59 bag changes
- Per treatment: 16 vs 35 bag changes, -20 bag changes

Lower fluid volumes reduce the number of solution bags and frequency of changes, easing nursing workload and improving efficiency.

Figure 1: Economic analysis



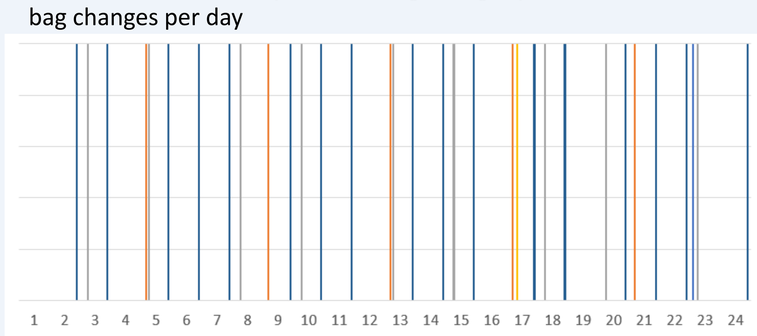
Scenario 1: high-band prices, not adjusted for citrate concentration; Scenario 2: low-band prices, not adjusted for citrate concentration; Scenario 3: high-band prices, adjusted for citrate concentration; Scenario 4: low-band prices, adjusted for citrate concentration.

Table 1: Breakdown of fluid volumes required with medium citrate CVVHD vs low citrate pre-post CVVHDF

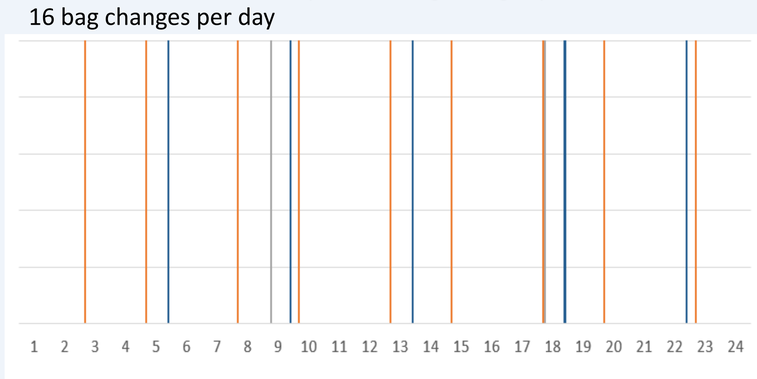
Fluid Volumes	Low citrate	Medium citrate	Difference
Total / h	3.668 mL	2.309 mL	-1.359 mL
Total / 24h	88.032 mL	55.416 mL	-32.616 mL
Total / treatment	264.096 mL	166.248 mL	-97.848 mL

Figure 2: Timetable of bag changes per 24 hours

Low CVVHDF citrate requires 106 bag changes per treatment, 35 bag changes per day



Medium CVVHD citrate requires 47 bag changes per treatment, 16 bag changes per day



Treatment protocol for medium citrate CVVHD: blood flow 100ml/min, dialysate flow 2000ml/h, 4% citrate 175ml/h, calcium solution 34ml/h. Treatment protocol for low citrate CVVHDF: blood flow 200ml/min, dialysate flow 2000ml/h, citrate solution 0.5% 1200ml/h, calcium solution 68ml/h, replacement fluids 300ml/h.

CONCLUSIONS

Selecting the appropriate citrate concentration in RCA and treatment modality can importantly affect hospital costs and operational efficiency. CVVHD protocols with medium citrate concentration can consistently decrease hospital costs and nursing staff workload, due to lower fluid volume requirements, thus increasing efficiency. Additional savings may result from less filter changes due to lower fluid volumes and different calcium infusion set-ups.[3] Furthermore, the lower number of bags required with medium citrate CVVHD protocols translates into reduced environmental waste, and potentially fewer incineration costs.

TCO assessments can better evaluate treatment efficiencies, allowing more comprehensive, value-based procurement decisions beyond unit cost comparisons.

REFERENCES

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