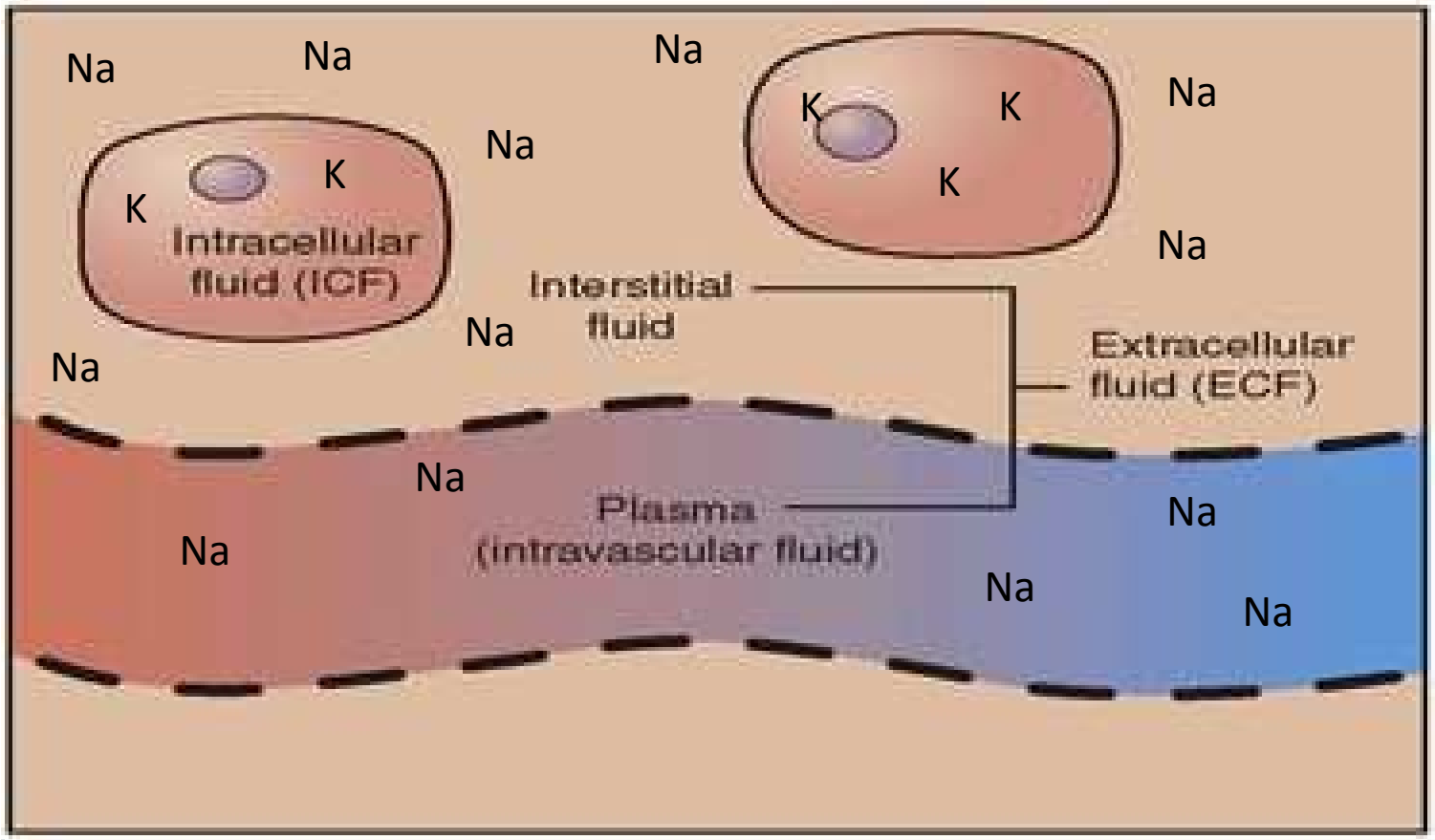
How much fluid should I take off today?

SKC in-service March 2015

Salt and Water



~60-70 kg M

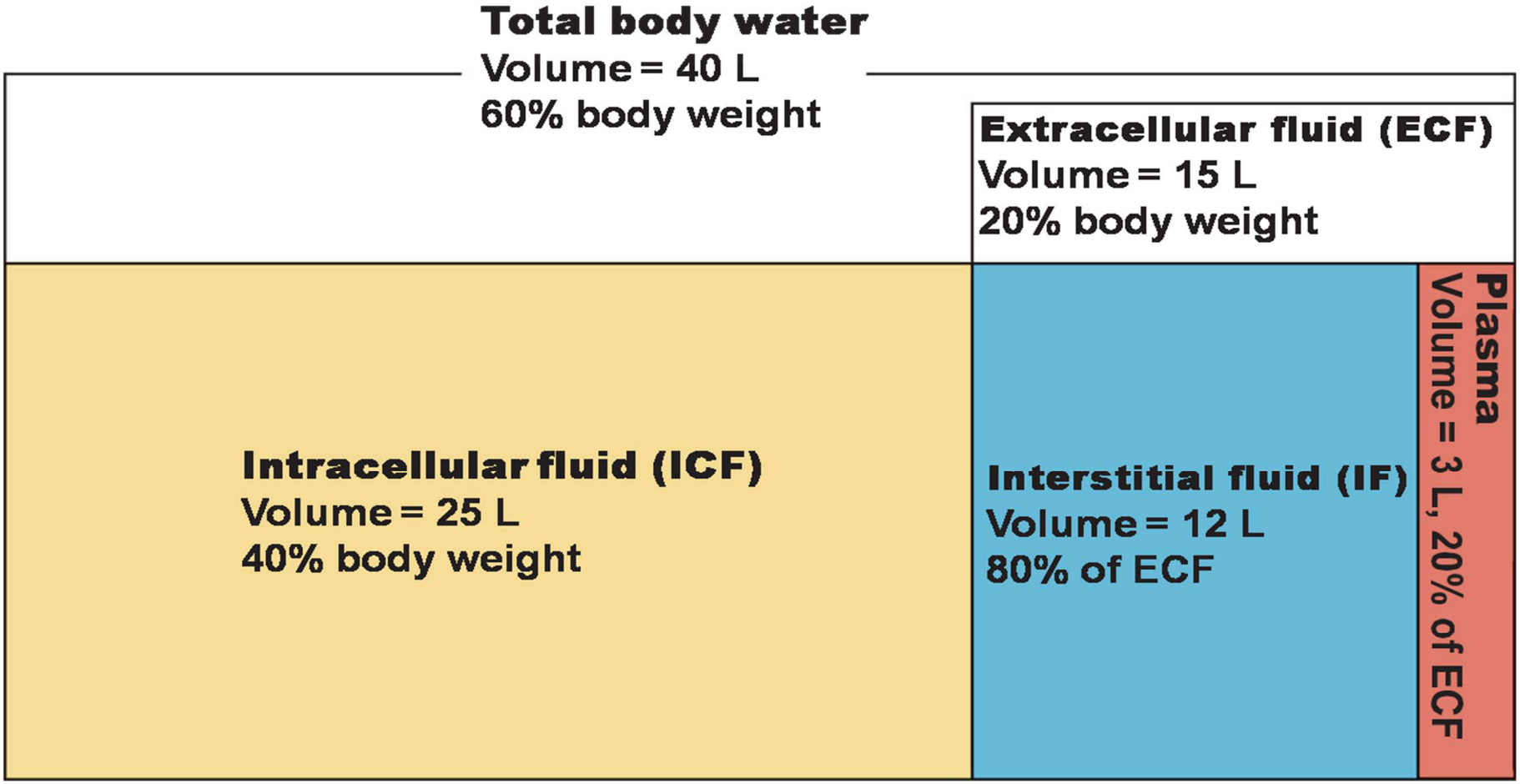


Figure 25.1

ECV Excess (Sodium Excess)

- Crackles/Rales in Lungs
- Edema
- Elevat
- Increa
  (ascites)
- Hypertension
- Dyspnea on exertion, cough, orthopnea

SERUM SODIUM DOES NOT TELL YOU ANYTHING ABOUT TOTAL BODY SODIUM LEVELS!

atient with relatively high serum albumin level of 28 g/l but
oedema and nephrotic-range proteinuria (3.3 g/d).

Water Excess (not = fluid overload)

- Serum sodium informs you about the amount of water in the body relative to the sodium level
- Sodium < 130 mEq/L = Too much water!
- Sodium > 145 mEq/L = Too little water!

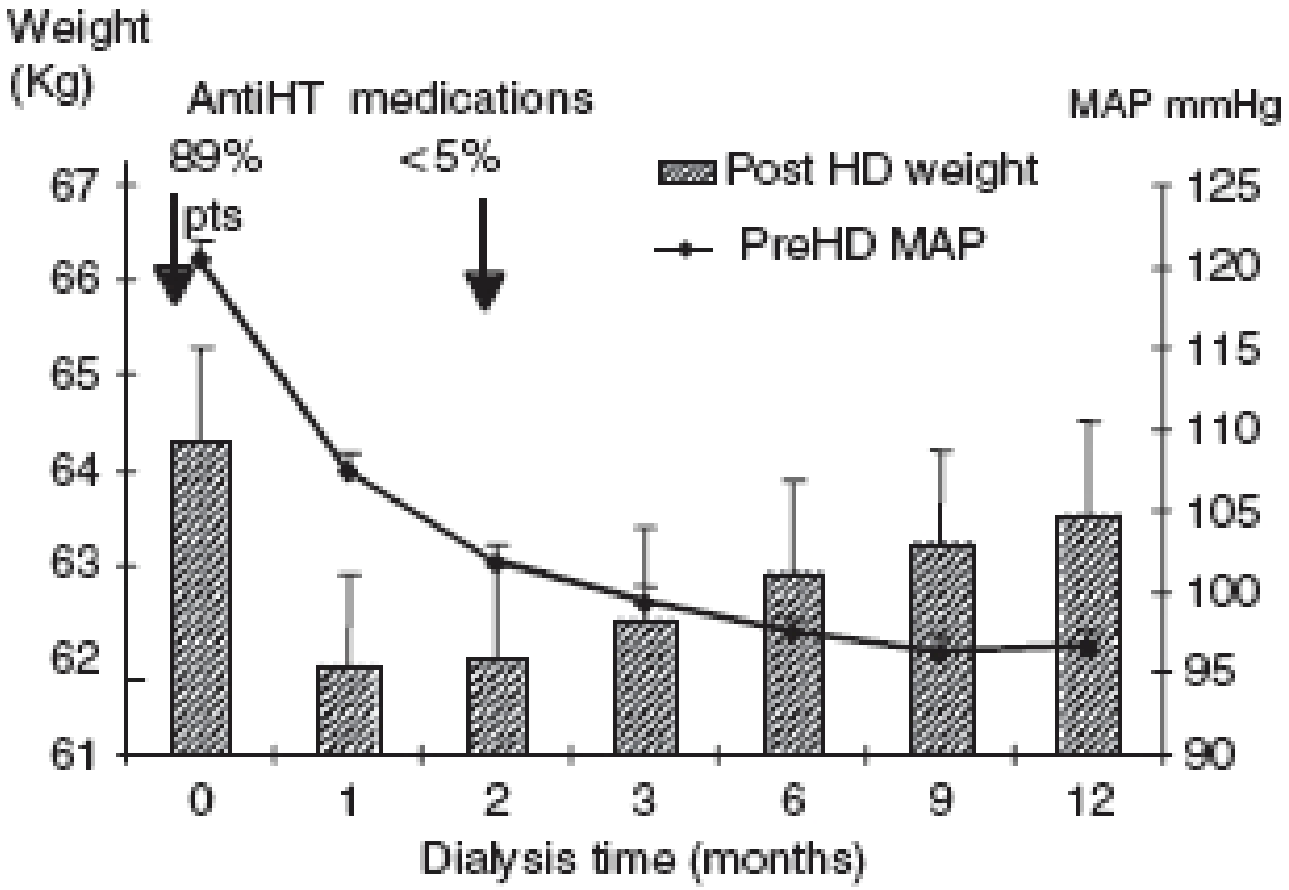
So I made the determination that my patient has ECV excess, how much fluid should I take off?

The dry weight method

- Pre dialysis weight – Total Ultrafiltration Volume = Post dialysis weight = “Dry” Weight

- Advantages:
  - Simple, easy to understand and implement
- Disadvantages:
  - Relies on accurate measurement of weight
  - Relies on accurate assessment of dry weight,

Dry weight changes over time (especially in the beginning!)



What happens if we take too little fluid off?

- Chronic volume overload
- Heart Failure
- Organ dysfunction
- Decreased activity
- Uncontrolled HTN
- Risk for MI, CVA
- Infection risk
- Wound healing issues
- Hospitalization

- In a blinded study of 269 patients, those with predialysis fluid overload surpassing 15% of their extracellular volume had an adjusted hazard ratio for all-cause mortality of 2.10 (90% CI 1.39–3.18), compared to those with fluid overload below 15% of their extracellular volume. (Nephrol Dial Transplant (2009) 24: 1574–1579)

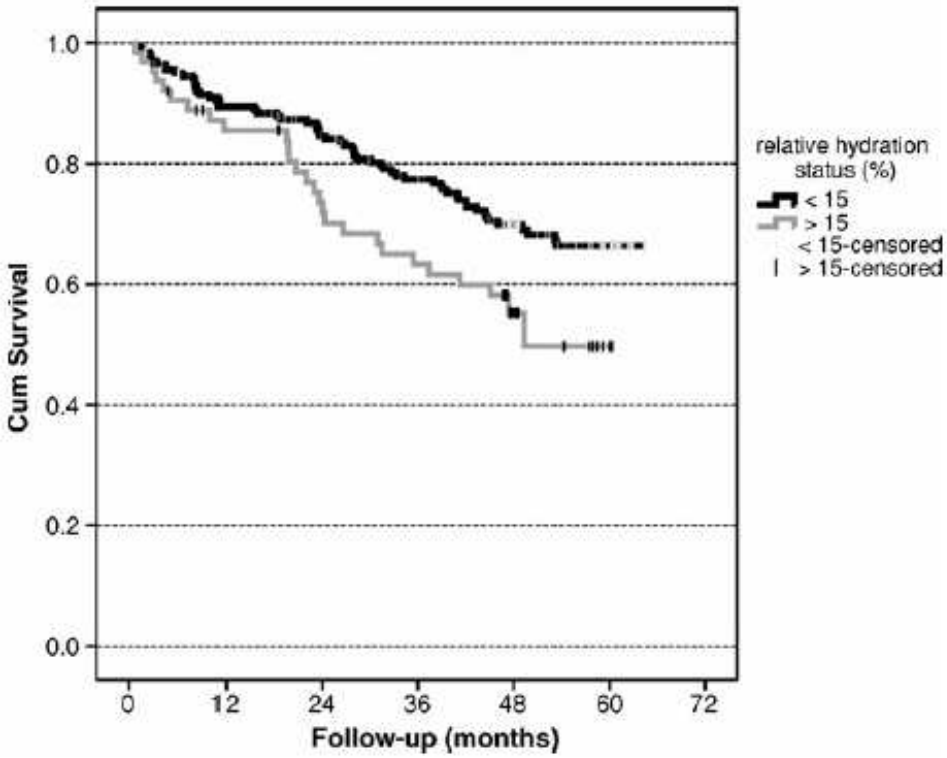


Fig. 1. Kaplan–Meier curve separating the patients for the relative hydration status (ΔHS >15%).

- In comparison to a positively selected reference population comprising 50 “normohydrated” patients from the “long, slow dialysis” center in Tassin/France, 35 fluid overloaded patients from another unit (an excess of 3.5-1.2 l predialysis, equivalent to 20.2 - 4.8% of their extracellular volume) had an adjusted hazard ratio for all-cause mortality of 3.41 (90% CI 1.62–7.17)

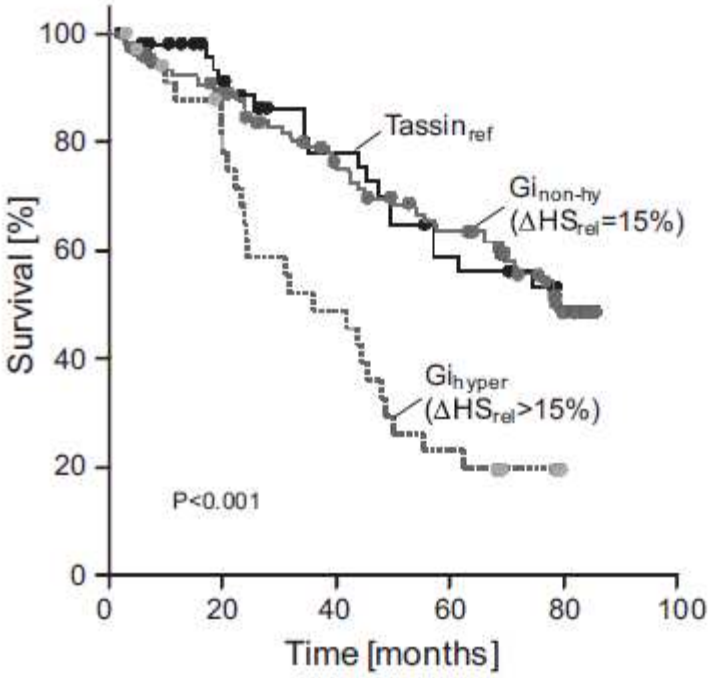
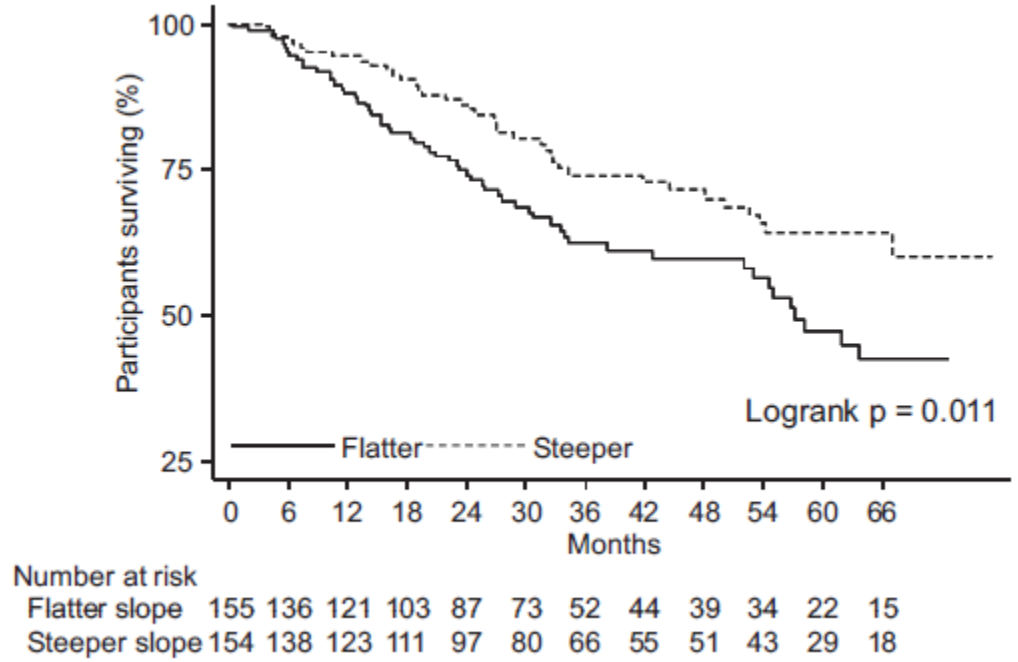
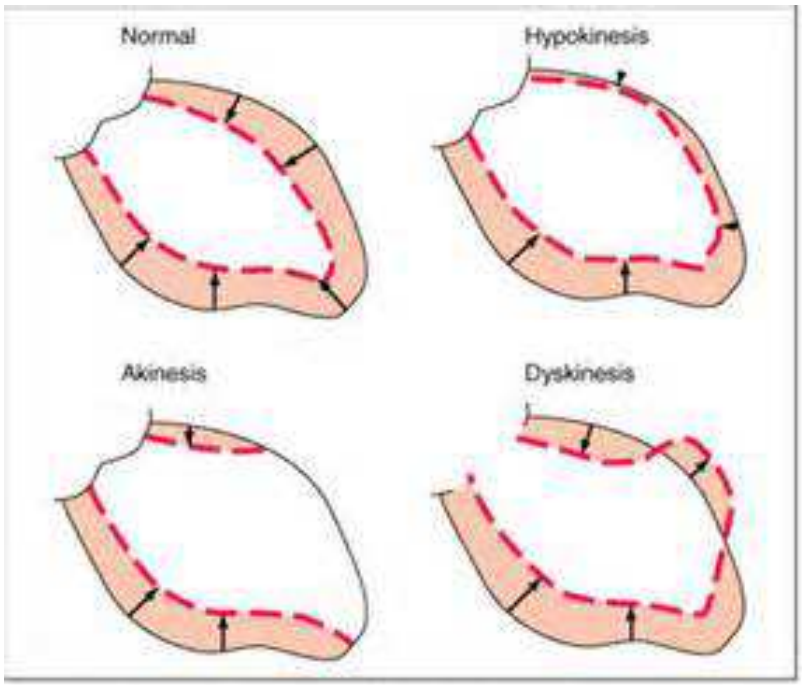


Fig. 3. Unadjusted Kaplan–Meier analysis for the three patient groups (Tassin$_{ref}$, Gi$_{non-hy}$, Gi$_{hyper}$) and the follow-up period of 6.5 years. All-cause mortality was considered as event.

In a study of 309 patients using a plasma volume monitor, those with rapid plasma refilling (a slope below the median of 1.39% per hour), an indicator of fluid overload, had a hazard ratio for mortality of 1.72 (95% CI 1.14–2.58) compared to patients with steeper slopes (*Hypertension*. 2010;56:512-517.).



What happens if we take too much fluid off?



Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine*, 17th Edition: http://www.accessmedicine.com

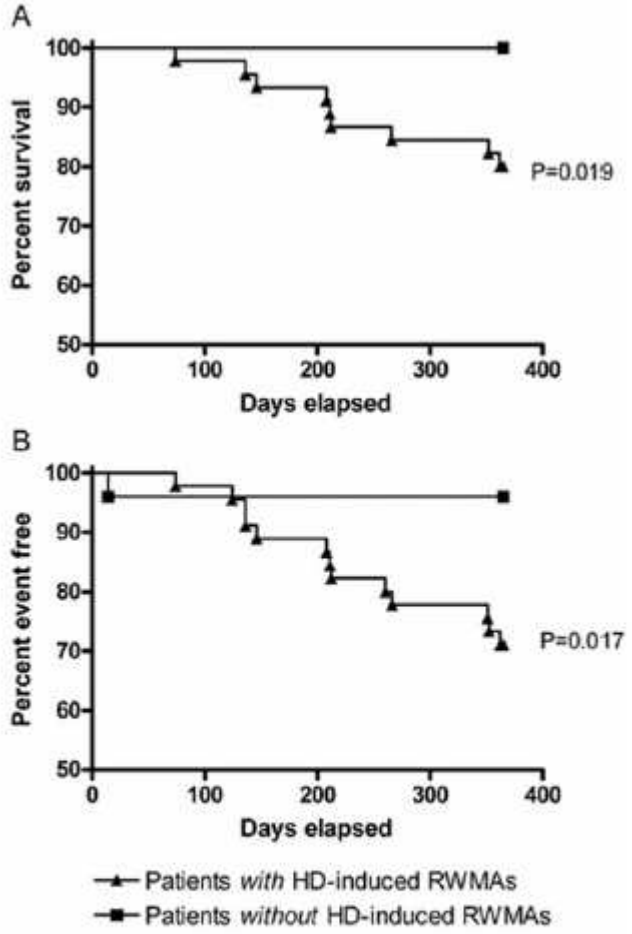


Figure 2. The association of hemodialysis-induced RWMAs with mortality and outcome. (A) The development of HD-induced RWMAs was associated with increased relative mortality at 12 mo ($P = 0.019$) and (B) reduced survival to a composite end point of mortality and time to first cardiovascular event ($P = 0.017$).

Clin J Am Soc Nephrol 4: 914–920, 2009

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Table 3. The effect of increasing ultrafiltration (UF) volume and worsening intradialytic haemodynamics on the development of HD-induced RWMAs

Factor associated with presence of myocardial stunning	Odds Ratio	*P* value
UF volume during HD of 1L	5.1	0.007
UF volume during HD of 1.5L	11.6	
UF volume during HD of 2L	26.2	
Maximum SBP reduction during HD of 10 mmHg	1.8	0.002
Maximum SBP reduction during HD of 20 mmHg	3.3	
Maximum SBP reduction during HD of 30 mmHg	6.0	

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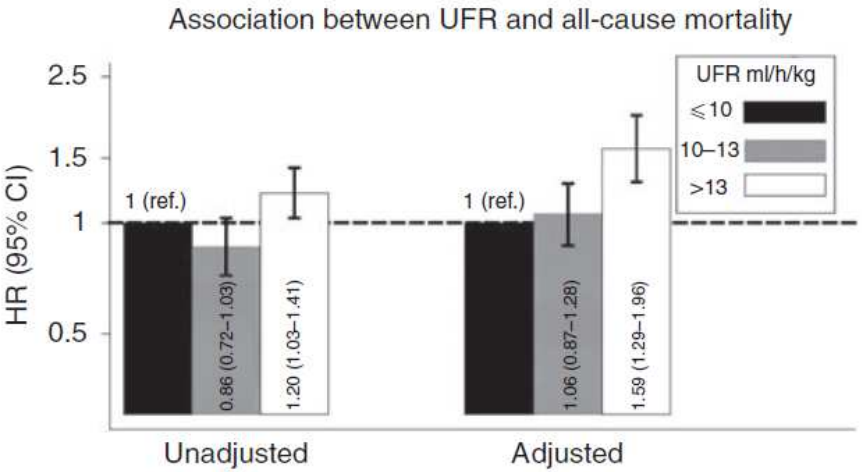
How much UF is too much?



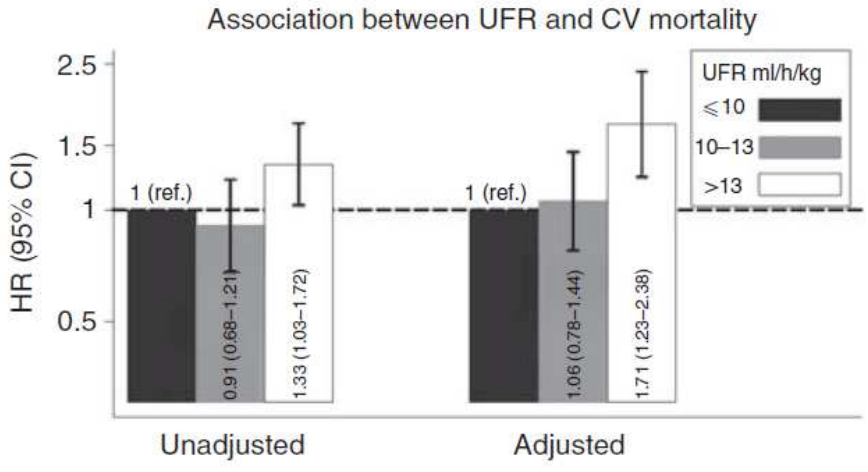


TABLE 1. Published associations between UFR and all-cause and cardiovascular mortality

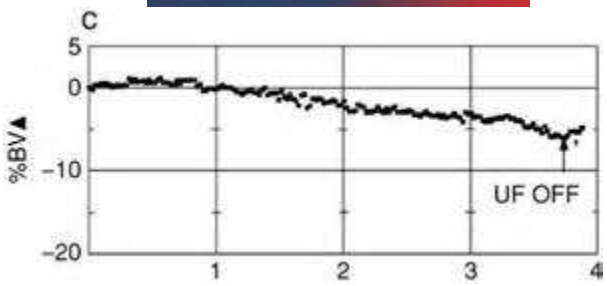
Study	Adjustment	Association with all-cause mortality	Association with cardiovascular mortality
Saran (2)			
≤10 ml/h per kg	Treatment time	1 (ref)	1 (ref)
> 10 ml/h per kg		1.09 (p = 0.02)	1.04 (p = 0.41)
Movilli (3)			
per 1 ml/h per kg	IDWG	1.22 (1.16–1.28)	NR
Flythe (4)			
≤10 ml/h per kg	IDWG	1 (ref)	1 (ref)
10–13 ml/h per kg		1.06 (0.87–1.26)	1.06 (0.78–1.44)
> 13 ml/h per kg		1.59 (1.29–1.96)	1.71 (1.23–2.38)

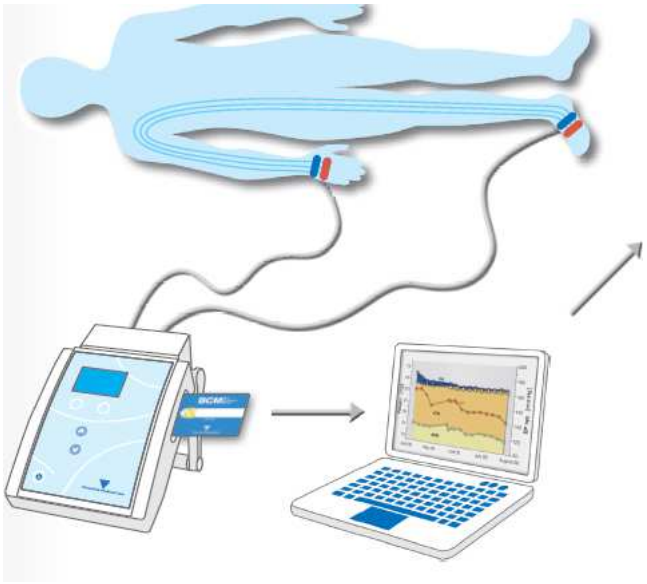
UFR, ultrafiltration rate; IDWG, interdialytic weight gain; NR, not reported.

Kidney International (2011) 79, 250–257

Better ways to evaluate fluid status?

- Bioimpedence
- Blood volume monitoring; Crit-Line, RPV
- US techniques, IVC/IJ diameter





What to expect in the future…

Fluid Metrics as Indicators of Quality:

1) Percentage of patients with average post dialysis weight >= 1kg above or below the target weight
2) Percentage of patients whose average UFR > 13 ml/kg/hr

Take home points

- Ultrafiltration rate > 13 ml/kg/hr (roughly 1L/hr) is too high
- Extend runs, more frequent runs to reduce high UFR
- For patients who do not tolerate UF consider:
  - Dietary modifications
  - ?Too many BP meds, pain meds
  - ?Diuretics / RRF
  - Cool dialysate
  - Ultrafiltration profiling (more UF early in run)
  - More frequent / longer runs
  - Peritoneal dialysis / Home HD