

Are haemodialysis patients at risk of excessive dehydration?

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Background

The association between high blood pressure and fluid overload has led to a tendency for nephrologists to remove as much fluid as possible from haemodialysis patients. The machine will withdraw fluid whether or not the patient has fluid to spare. With no reliable bedside tool for assessing fluid status, this could lead to excessive dehydration, especially in hypertensive patients.

In the mid-1990s, our unit was one of the first in the United Kingdom (UK) to explore the use of blood-volume monitoring (BVM) during dialysis. The device we evaluated was intended to alarm when it identified a 'critical' drop in blood volume. We realised that in over a quarter of the patients we monitored, the blood volume did not drop at all, even though a significant volume of fluid was removed. This rapid refilling of the circulation throughout the session indicated that these patients were overloaded post-dialysis.

Many of the patients who were found to be overloaded had normal or low blood pressure. BVM was especially helpful in managing the hypotensive patients, as seeing a 'flat-line' as fluid was removed showed that the patient was maintaining their blood volume. This gave staff the confidence to take more fluid off and BVM became a routine part of assessing fluid status and setting target weight. Judging from the responses to a recent question on the RenalPro email discussion group (<http://www.mailman.srv.ualberta.ca/mailman/listinfo/renalpro>), many other units around the world adopted this practice.

Body composition monitoring

In 2009, when we introduced body composition monitoring (BCM), we found that many patients were excessively dehydrated. Being a little dehydrated post-dialysis can help patients with little or no residual renal function to stay close to normal hydration during the intradialytic period. Patients who are well nourished and relatively fit can usually tolerate this and often feel better as they minimise pre-dialysis oedema. But excessive dehydration can lead to cramps, hypotension (sometimes) and a longer recovery time. It can also accelerate loss of residual renal function and increase the risk of a clotted fistula or graft.

The patients most likely to be excessively dehydrated were those with high blood pressure and/or high body mass index (BMI). Those with high blood pressure were assumed to be overloaded

so their target weight was decreased until the patient was unable to cope with further reduction. The poor relationship between fluid status and blood pressure is shown in Figure 1. The expected increase in blood pressure with fluid overload does occur, but only as a trend for the population. For an individual patient, we found that blood pressure was a poor predictor of fluid status and those on the left of the scatter plot, who were the most dehydrated, tended to have high rather than low blood pressure.

For those with high BMI, especially when close to the limit for transplant listing (35 kg/m^2 in our unit), the patients were reluctant to accept that they had gained weight so their target weight was kept too low. BVM is not sensitive to dehydration because the rate that blood volume decreases when going from slightly overloaded to normal is similar to the way it decreases when going from slightly dehydrated to excessively dehydrated.

Patients with good residual function seem to be less tolerant of excessive dehydration. Their natural response is likely to be to override any fluid restriction and drink themselves back to normal hydration (and diuresis) as soon as they get home. Reducing target weight for blood pressure control in these patients will simply increase their interdialytic fluid gain (IDFG) and make their post-dialysis blood pressure even higher due

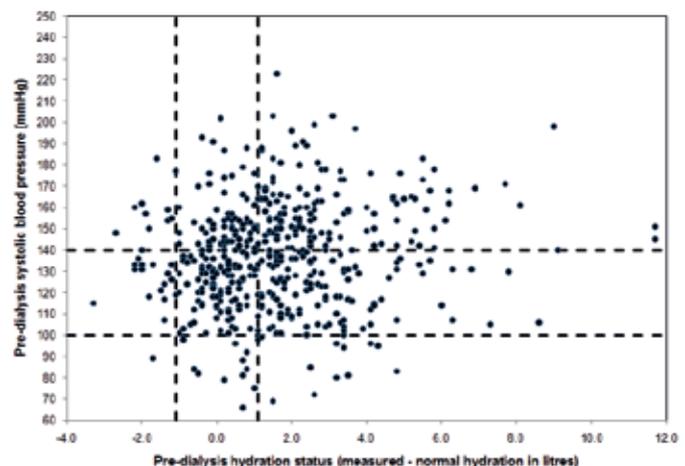


Figure 1: Pre-dialysis systolic blood pressure vs hydration status for the first BCM measurement made in 474 haemodialysis patients under the care of Leeds Teaching Hospitals. Reproduced from Lindley et al. <http://www.intechopen.com/books/technical-problems-in-patients-on-hemodialysis/management-of-fluid-status-in-haemodialysis-patients-the-roles-of-technology-and-dietary-advice>

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to activation of the renin angiotensin system. Thrice-weekly hypovolaemia will damage the kidneys. This may well be the reason that peritoneal dialysis is considered to protect residual function while haemodialysis soon wipes it out.

Our renal unit now uses BCM to set target weights. We look for a post-dialysis weight that enables the patient to remain close to normal hydration throughout the interdialytic period, with optimal control of blood pressure and without experiencing discomfort or compromising residual function. We still use BVM, but for its original purpose, which is to look for strategies that help maintain blood volume in patients whose intradialytic hypotension is due to poor refilling, rather than dehydration.

What if you don't have BCM?

There are strategies that can be implemented to prevent excessive dehydration if you don't have BCM:

- If patients are producing urine, make sure that their IDFG does not increase when you decrease their target weight.
 - Monitor patients who are passing urine and always come for dialysis at more or less the same weight. Try increasing their target weight incrementally and see if their IDFG decreases and their pre-dialysis weight stays the same.
 - If patients can manage without fluid removal on dialysis, check their GFR using an interdialytic urine collection to see if they have recovered clearance and can move to twice-weekly dialysis. If they still have clinical signs of fluid overload, see if their weight comes down with a diuretic.
- If trying to control hypertension, check that the patient's blood pressure is lower when their weight is lower, otherwise you may do more harm than good by reducing target weight.
 - When using BVM, check for refilling by switching off the ultrafiltration once the blood volume has started to drop. If there is little or no fluid coming in from the tissues, the patient may be at risk of excessive haemoconcentration.

Summary

Removal of fluid by ultrafiltration during haemodialysis frequently leads to dehydration. Many patients tolerate some dehydration well and prefer to finish the session a little dry to minimise intradialytic overload. Others become symptomatic when still close to normal hydration. Excessive dehydration, even when tolerated, should not be used to control hypertension, especially in patients with residual renal function or a high risk of access stenosis. The information provided by BCM can help establish a target weight that gives the ideal fluid management for each patient. BCM can reduce the guesswork in assessing fluid status and help prevent us subjecting the people we care for to unnecessary discomfort, fatigue and loss of residual renal function.

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