

HYPOTENSION AND HAEMODIALYSIS

THE BOTTOM LINE

- 1. Prevention of hypotension during haemodialysis (IDH)**
- 2. Treatment of hypotension during haemodialysis (IDH)**
- 3. Withholding dialysis when SBP <70**

1. Prevention of hypotension during dialysis

Regular comprehensive fluid assessment by nurses prior to dialysis and by doctors at clinic leading to vigilant adjustment of dry weight.

Withholding antihypertensive medications which are known to cause hypotension during dialysis treatments on consultation with nephrologist.

In patients who are prone to IDH, pulse rate and BP should be taken hourly to detect changes to baseline before they result in symptoms.

Initiate PACE modifications in patients in which hypotension is a usual finding (PACE modifications must be not be grossly abnormal).

Food intake during or just before dialysis should be avoided in patients with frequent episodes of IDH. In malnourished patients, the haemodynamic effects of food intake during dialysis should be balanced against the nutritional needs of the patient.

Utilisation of BVS monitoring and other technologies to support fluid control.

Cool dialysate temperature (35–C be prescribed in patients with frequent episodes of IDH).

UF and Na profiling might be beneficial.

Haemodialysis patients must be instructed and counselled regularly by a Dietitian regarding salt and fluid restrictions.

2. Treatment of hypotension during dialysis

The Trendelenburg position should be considered in the treatment of IDH. However, efficacy may be limited.

Ultrafiltration should be stopped during an episode of IDH.

Isotonic saline should be infused in patients unresponsive to stopping ultrafiltration and Trendelenburg's position during an episode of IDH.

Infusion of colloid solutions should be considered in patients who remain unresponsive to saline infusion (Evidence level III).

3. Withholding haemodialysis when SBP <70

Where the patient is at risk of a cardiac arrest on dialysis, treatment will be withheld. Consider palliative care or high dependency/intensive care. Does the patient have LVF and lives with severe hypotension? Modified PACE criteria or NFR order.

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WHAT OTHER GUIDELINES SAY

CARI – none

KDIGO - Just had a conference to discuss refer to (Levin et al., 2009). Blood pressure in chronic kidney disease stage 5D- report from a kidney disease, improving global outcomes controversies conference

http://www.kdigo.org/meetings_events/pdf/KDIGO%20BP%20in%20CKD_Published%20Online%20Version.pdf

Canadian

http://jasn.asnjournals.org/cgi/reprint/17/3_suppl_1/S1?maxtoshow=&hits=10&RESULTFORMAT=1&author1=Bruce+F.+Culleton&andorexacttitle=and&andorexacttitleabs=and&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&volume=17&resource=HWCIT

Clinical Indications for the Use of Frequent and Sustained Hemodialysis

Recommendations

1. In patients with poorly controlled BP, consider the use of frequent hemodialysis (Grade D) or sustained hemodialysis. (Grade C)
2. In patients with significant left ventricular hypertrophy or impaired left ventricular systolic function, consider the use of frequent hemodialysis as adjunctive therapy. (Grade D)
3. In patients who exhibit hemodynamic instability with conventional hemodialysis, the use of frequent hemodialysis should be considered. (Grade D, opinion)

Management of Hypertension

Recommendations

4. Avoid positive sodium balance induced by hypertonic dialysate and/or sodium profiling during volume status adjustment. (Grade C)
5. Reduce dialysate temperature when intradialytic hypotension limits ultrafiltration. (Grade C)
6. If antihypertensive agents are required, select agents with pharmacokinetics suitable for dialysis patients and appropriate for existing co morbid conditions. (Grade D)

KDOQI

[http://www.ajkd.org/article/S0272-6386\(06\)00554-3/fulltext#sec8.2.4](http://www.ajkd.org/article/S0272-6386(06)00554-3/fulltext#sec8.2.4)

KDOQI – CLINICAL PRACTICE GUIDELINES FOR HEMODIALYSIS ADEQUACY

GUIDELINE 5. CONTROL OF VOLUME AND BLOOD PRESSURE

5.1 The ultrafiltration component of the HD prescription should be optimized with a goal to render the patient euvolemic and normotensive. This includes counselling the patient on sodium and fluid restriction, adequate ultrafiltration, and the use of diuretics in patients with RKF. (A)

5.2 Daily dietary sodium intake should be restricted to no more than 5 g of sodium chloride (2.0 g or 85 mmol of sodium). (A)

5.3 Increasing positive sodium balance by “sodium profiling” or using a high dialysate sodium concentration should be avoided. (B)

Guideline 1.1.1 Hydration state should be regularly assessed by clinical examination (Opinion).
Guideline 1.1.2 Objective methods to assess fluid state should be considered in a patient with frequent IDH when clinical examination is inconclusive (Level III).
Guideline 1.2 Blood pressure and heart frequency rate should be measured frequently during dialysis in order to anticipate IDH (Opinion).
Guideline 1.3 Cardiac evaluation should be performed in patients with frequent episodes of IDH (Opinion).
Guideline 2.1 In order to control inter-dialytic weight gain and reduce the risk of IDH, dietary salt intake should be assessed and not exceed 6 g/d ay unless contra-indicated (Evidence level III).
Guideline 2.2 Food intake during or just before dialysis should be avoided in patients with frequent episodes of IDH (Evidence level II). In malnourished patients, the haemodynamic effects of food intake during dialysis should be balanced against the nutritional needs of the patient (Opinion)
Guideline 3.1.1 Pulsed UF profiles should not be used for the prevention of IDH (Evidence level III).
Guideline 3.1.2a Individualized, automatic BV control should be considered as a second-line option in patients with refractory IDH (Evidence level II).
Guideline 3.1.2b Manual adjustment of ultrafiltration according to a fixed protocol based on changes in blood volume should not be performed (Evidence level II).
Guideline 3.2.1 Although sodium profiling with suprphysiological dialysate sodium concentrations and high sodium dialysate (144 mmol/l) are effective in reducing IDH, they should not be used routinely because of an enhanced risk of thirst, hypertension and increased inter-dialytic weight gain (Evidence level II).
Guideline 3.2.2 Bicarbonate dialysis should be used to prevent IDH (Evidence level III).
Guideline 3.2.3 The use of a dialysate calcium concentration of 1.50 mmol/l should be considered in patients with frequent episodes of IDH, unless contraindications are present (Evidence level II).
Guideline 3.2.4a In patients with frequent episodes of IDH, low (0.25 mmol/l) magnesium dialysate should be avoided, especially in combination with low-calcium dialysate (Level II).
Guideline 3.2.4b Glucose-free dialysate concentrations should be avoided in diabetics (Opinion).
Guideline 3.3 No particular dialysis membranes should be preferred to prevent IDH (Level II).
Guideline 3.4.1 Cool dialysate temperature dialysis (35–36°C) or isothermic treatments by blood temperature controlled feedback should be prescribed in patients with frequent episodes of IDH (Evidence level I).
Guideline 3.4.2 With cool temperature dialysis, dialysate temperature should be gradually reduced in steps of 0.5°C from 36.5°C until symptoms are controlled (Opinion).
Guideline 3.4.3 Dialysate temperatures <35°C should not be used (Opinion).
Guideline 3.5.1 Haemo(dia)filtration techniques should not be considered a first-line option for the prevention of IDH, but as a possible alternative to cool dialysis (Evidence level II).
Guideline 3.5.2 Sequential isolated ultrafiltration followed by isovolemic dialysis should not be used as a regular strategy for the prevention of IDH (Evidence level II).
Guideline 3.6 A prolongation in dialysis time or an increase in dialysis frequency should be considered in patients with frequent episodes of IDH (Levels II–III).
Guideline 3.7 A treatment change to peritoneal dialysis should be considered in patients who remain refractory to interventions for the prevention of IDH (Opinion).
Guideline 4.1 In patients with frequent episodes of IDH, antihypertensive agents should be given with caution prior to dialysis depending on pharmacodynamics, but should not be routinely withheld on the day of haemodialysis treatment (Evidence level III).
Guideline 4.2 Midodrine should be considered if other treatment options have failed (Evidence level I).
Guideline 4.3 L-carnitine supplementation should be considered for the prevention of IDH if other treatment options have failed (Evidence level III).
Guideline 6.1 The Trendelenburg position should be considered in the treatment of IDH. However, efficacy may be limited (Opinion).
Guideline 6.3.1 Isotonic saline should be infused in patients unresponsive to stopping ultrafiltration and Trendelenburg's position during an episode of IDH (Evidence level II).
Guideline 6.3.2 Infusion of colloid solutions should be considered in patients who remain unresponsive to saline infusion (Evidence level III).
Guideline 6.2 Ultrafiltration should be stopped during an episode of IDH (evidence level III).
Guideline 6.4 The development a centre-specific protocol, with stepwise interventions for the treatment of IDH should be considered (Evidence level III).

KDOQI – CLINICAL PRACTICE GUIDELINES FOR HEMODIALYSIS ADEQUACY

GUIDELINE 5. CONTROL OF VOLUME AND BLOOD PRESSURE

There is ample evidence in the non-CKD population that optimal control of blood pressure influences mortality. In the HD population, available evidence indicates that hypotension does not indicate an achievement of dry weight (Hlebovy, 2006), improved intradialytic stability can be achieved with BV-controlled UF (Palmer and Henrich, 2008; Gabrielli et al., 2009), sodium and UF profiling can be beneficial (Stiller et al., 2001; Kooman et al., 2007), albumin can be used to maintain systolic BP (van der Sande et al., 2000), fluid assessment is important, reducing salt intake can reduce inter-dialytic weight gain, food intake during dialysis can cause splanchnic vasodilation, lowering dialysate temperature and timing antihypertensive agents (Kooman et al., 2007) can all help to reduce incidences of hypotension on dialysis.

BACKGROUND

What is IDH?

Haemodynamic instability during conventional haemodialysis is commonly encountered and occurs in 20-30% of dialysis sessions (Jindal et al., 2006). The definition of intra-dialytic hypotension (IDH) is not standardised in the literature but it is proposed that future guidelines conform to KDOQI guidelines: IDH is a decrease in systolic BP ≥ 20 mmHg or a decrease in MAP by 10mmHg associated with clinical events and need for nursing intervention (Kooman et al., 2007).

Sequelae of IDH

Hypotension during dialysis has many adverse effects and potential life-threatening consequences. By impairing tissue perfusion, low blood pressures can compromise dialysis adequacy. Hypotension induced by overzealous ultrafiltration also may contribute to loss of RRF and, in predisposed patients, coronary and/or cerebral ischemia.

Common signs of IDH

The common signs of hypotension are that the patient will feel dizzy, light-headed, or nauseated. Some experience muscle cramps. Dialysis nurses may notice signs such as lack of alertness. Some patients may not experience any symptoms until the BP is dangerously low (Daugirdas et al., 2007).

What are the causes of IDH

IDH may occur as a result of a decline in blood volume, impaired cardiac response and impaired constriction of resistance and capacitance vessels and depending on the patient and treatment related factors the relative importance of these factors will vary (Kooman et al., 2007). Patient's medical background needs to be considered such as LVF (what is their normal BP?)

Methods to reduce incidence of IDH

A patient's dry weight is defined as the weight present at a physiological ECV state (Raimann et al., 2008). Dry weight is set at the weight below which unacceptable symptoms, such as cramping, nausea and vomiting or hypotension occur (Palmer and Henrich, 2008). Incorrect assessment of dry weight may result either in under hydration or over hydration in dialysis patients. Physical examination should always be the basis for assessment of dry weight in dialysis patients; however a number of methods have been proposed to define dry weight more objectively:

Objective tools to determine dry weight in haemodialysis patients

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- Blood volume monitoring
 - Relative change during treatment
 - Blood volume with ultrafiltration pulse
 - Ultrasound assessment of IVC
 - IVC diameter
 - IVC collapsibility index (fractional decrease of diameter during breathing cycle)
 - BNP, N-terminal pro- BNP, atrial natriuretic peptide levels
 - Bioimpedance method
 - Whole body (wrist to ankle)
 - Segmental
 - Continuous intradialytic calf measurements
 - Extravascular lung water index (invasive)
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Adapted from Palmer et al 2008

To avoid hypotension, dry weight should be systematically re evaluated after each dialysis treatment. Dry weight may change, for example, when a newly dialysed patient becomes less uraemic, regains appetite, and gains muscle and non fluid weight (reflected by an increase in serum creatinine level), or when a patient has an intercurrent illness and loses muscle and tissue weight (Jarger and Mehta, 1999).

There is exhaustive literature on other methods used to prevent or reduce the incidence of IDH:

Prevention or reduction of hypotension
Increase dialysis time/frequency:
For some patients, the conventional dialysis time is too short for their ultrafiltration requirements to be readily fulfilled. Attempts to accelerate ultrafiltration in these patients may precipitate hypovolemia and hypotension. Conversion to frequent hemodialysis has been shown to improve patients' overall sense of well-being
Use of appropriate ultrafiltration techniques:
Blood volume controlled treatments involve UF and or dialysate conductivity adjustments according to changes in relative blood volume. KDOQI: ultrafiltration can be segregated temporally from diffusive clearance by performing sequential ultrafiltration/clearance. If intradialytic weight gain is excessive the length of the hemodialysis treatment should be extended so that the hourly ultrafiltration rate is lower (KDOQI, 2006)
Reduction in sodium intake:
Counselling the patient on sodium and fluid restriction i.e. no more than 5 g of sodium chloride (2.0 g or 85 mmol of sodium). (KDOQI, 2006)
Avoidance of food on dialysis:
Oral intake of food and fluid has been associated with IDH. (Benaroya and Iliescu, 2008). KDOQI states "intake immediately prior to or during hemodialysis causes a decrease in peripheral vascular resistance and hence may result in hypotension"
Lifestyle interventions:

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Limiting fluid intake; counselling patient to adjust fluid intake when food intake is robust.
Withholding antihypertensive medications prior to dialysis:
Tapering and adjusting antihypertensive therapy as patients lose excess fluid (KDOQI, 2006). Check dosing and timing of antihypertensive therapy (Kooman et al., 2007).
Dialysate composition:
“The dialysate solute concentration can also be manipulated to attenuate the likelihood of intradialytic hypotension and cramps. Increasing the dialysate sodium concentration (148 mEq/L), especially early in the dialysis session, followed by a continuous or stepwise decrease later in the treatment ("sodium ramping") is a simple and effective means of ameliorating intradialytic hypotension and cramps” (KDOQI, 2006; Kooman et al., 2007)
Sodium profiling:
Sodium profiling, a technique that increases dialysate sodium concentration early in treatment (e.g., 145 to 155 mmol/L), followed by a progressive decrease (linear, step, or logarithmic) to a lower value (e.g., 135 to 140 mmol/L) at the end of dialysis. However, if sodium profiling is not appropriately conducted, sodium accumulation with resulting augmented thirst, increase of interdialytic weight gain, and hypertension may result. Reviews of the large volume of literature on this topic of sodium profiling showed that sodium profiling is of uncertain benefit (KDOQI, 2006; Kooman et al., 2007).
Modification to dialysate temperature:
“Reducing the dialysate temperature from 37°C to 34-35°C increases peripheral vasoconstriction and cardiac output, thereby reducing the occurrence of hypotension and accompanying symptoms. This benefit is achieved secondary to increased sympathetic tone. This intervention is beneficial even in patients who have excessive weight gains. Cold dialysis does not compromise urea clearance or increase urea rebound, but does induce mild to intolerable symptomatic hypothermia in some patients.” (KDOQI, 2006; Kooman et al., 2007)

Note: Does the patient require palliative care? The surprise question: “Would you be surprised if the patient died in the next 12 months?” If no, consider if the person has palliative care needs (Brown et al., 2007).

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